THE GLASS INDUSTRY

VOLUME 27, NUMBER 12, DECEMBER, 1946

BROCKWAY ENTERS NEW TERRITORY WITH MUSKOGEE PLANT

Best features of other Brockway units and some new innovations are incorporated in Oklahoma factory. Decorating department to be added soon.

Plant No. 3 of the Brockway Glass Co., Inc., for which open house was held the last week of October, this year, is producing 225,000 glass bottles a day with a payroll of 170 persons working four six-hour shifts in the new $1,250,000 plant at Muskogee, Oklahoma, first entry of the company into the southwestern territory.

The plant, located a mile and a half northwest of town on the "Frisco" railway tracks is shipping out 175 freight carloads of glassware to points all over the south and southwest. Before locating in Muskogee Brockway officials and the Chamber of Commerce of that city conducted extensive surveys of the area and found the plant's capacity could be more than sold within the area itself. The result is that the plant has been constructed so that it can easily be expanded and enlarged and involves the latest techniques in glassware production as well as some individual set-ups designed to fit individual problems at the plant itself.

The plant prior to its use by Brockway had covered 60,000 square feet of floor space used by the DeCamp Consolidated Glass Casket Company. After the company had ceased production the Muskogee Chamber of Commerce sought to have the plant put into production so contacted Brockway officials in the east and as a result of the ensuing negotiations local citizens purchased $250,000 in preferred stock of the Brockway Glass Company and brought this organization to the southwest with the plant which now represents a $1,250,000 investment, according to F. B. Hess, vice president in charge of production.

The completed plant employs some 135,000 square feet of space and another 135,000 square feet could be added without additional purchase of property when needed.

Present production of the four bottle making machines in use is being employed in the manufacture of wide-mouthed containers and soft drink types.

"The plant is so laid out that we can double capacity at any time we believe future business merits such a step," Mr. Hess stated. An immediate expansion now under construction at the plant is a decorating department for ceramic color labeling of soft drink bottles. The set-up will be an exact duplicate of that now in use at Brockway, Pa. A fully automatic batch plant will be added in the next 5 to 6 months, together with the fifth 5-Section I.S. Machine, space for which has been provided in the original construction.

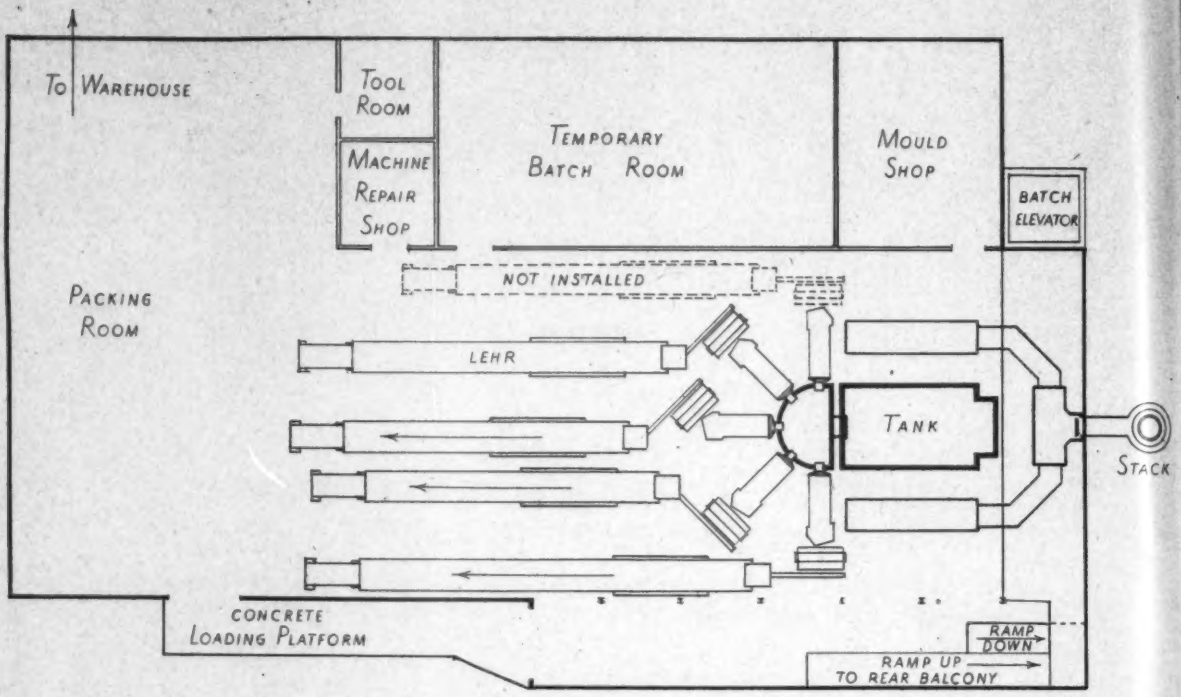
The plant now uses 50 tons of sand from Oklahoma and Arkansas deposits, about 20 tons of limestone from Missouri, about 20 tons each of soda ash from Louisiana and 7 tons of feldspar from Wyoming and Colorado during each day's operations.

Most of the present management personnel of this new Brockway unit was brought from the other Brockway plants in Pennsylvania. This staff includes R. A. Jacobs, plant manager; R. M. Kirkpatrick, resident sales manager; Ellen Mix, secretary; R. D. Carleton, packing room superintendent; Emil Hrinya, production superintendent; Dewey Shiplett, mold shop foreman; Carl Johnson, batch and furnace foreman; Clarence Miller, maintenance foreman; T. R. Hanson, construction superintendent; John Sherbach, shipping foreman; Louis Boyer, George Keister, Joseph Babel, John Muscatel, Charles Haggard, all production foremen; and Robert DeNoon and James Clutter, packing room foremen.

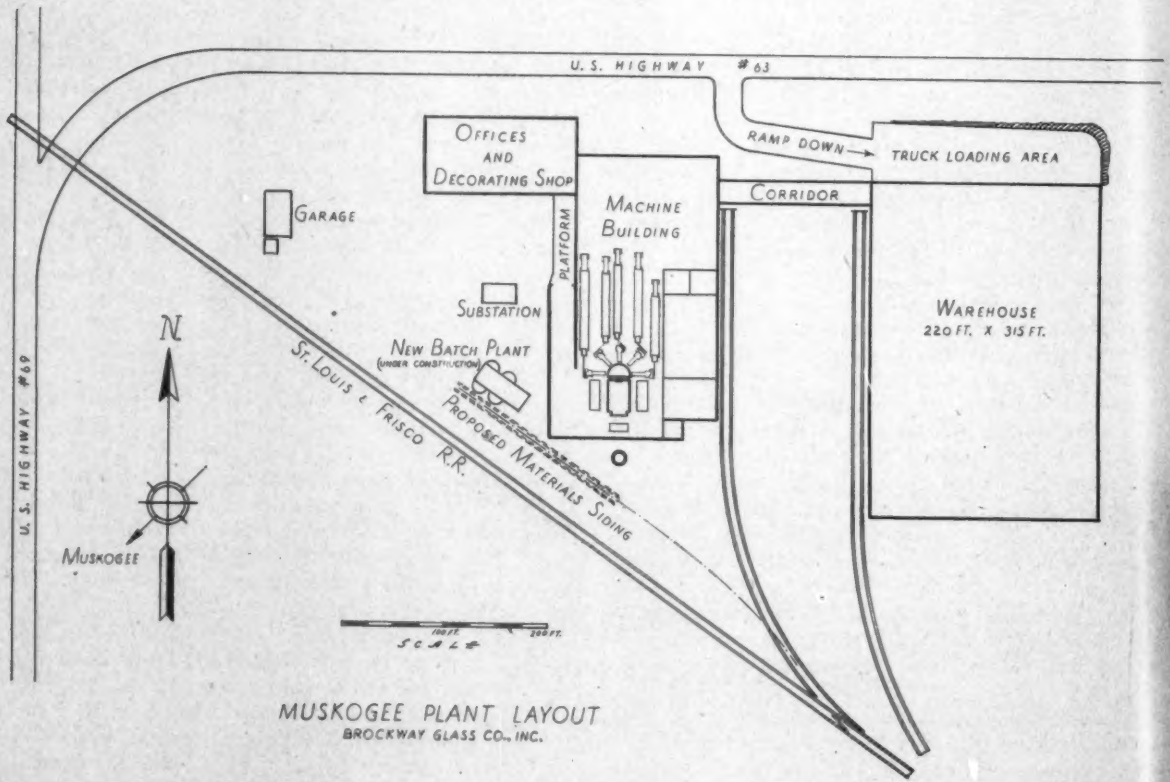
All other workers for the plant have been recruited from the Muskogee area and are still in the process of being trained on the job.

Original construction of plant Number 3 was under the guidance of L. F. Robertson, Chief Engineer, who designed and engineered construction of Plant No. 3, assisted on the Muskogee location by Tom R. Hanson who is now on the Muskogee plant staff.

The general pattern employed in construction of plant



MACHINE FLOOR LAYOUT



MUSKOGEE PLANT LAYOUT
BROCKWAY GLASS CO., INC.

Left to right: F. B. Hess, V.P. in Charge of Manufacturing; R. A. Jacobs, Plant Manager; T. W. McVehil, Director and General Plant Supt.; Tom R. Hanson, Supt. of construction; and R. M. Kirkpatrick, Resident Sales Manager, Plant No. 3.

number two (see GLASS INDUSTRY, July, 1941), was followed in laying out and constructing the Muskogee plant with improvement experiences and adjustments to fit local production problems added as construction went ahead.

Top consideration in construction of plant Number 3 was flexibility of operation and ease of immediate and future expansion for all indications are that Number 3 will see additional expansion before another year is out. Such additions as more warehouse space and the construction of a separate batch plant are contemplated.

Water supply is obtained from city facilities which are so ample that officials decided against construction of any plant owned reservoirs or individual water systems. The plant lines tie-in to the main lines before they enter the city itself and provide sufficient water supply if present production capacity of the plant were to be doubled.

Furl, natural gas and electricity are also obtained from the outside as it was found prevailing southwestern low rates were such that the company could purchase these two commodities for a third of the cost of production within the plant.

A glance at the illustration showing the plant exterior and the schematic layout will show the plant consists of a three story brick building to the right (wherein are housed offices, employe facilities and the decorating department as well as similar units), the main production building in the center with its dome open to the sky and the huge warehouse to the left. Warehouse and main plant are connected by a covered tunnelway and the area between the plants is used for trackage to the warehouse and to the plant itself.

The main buildings are of metal, fifty per cent ventilated and aired with panels consisting of two side units which rotate on a center pole and thus open easily to supply light and ventilation.

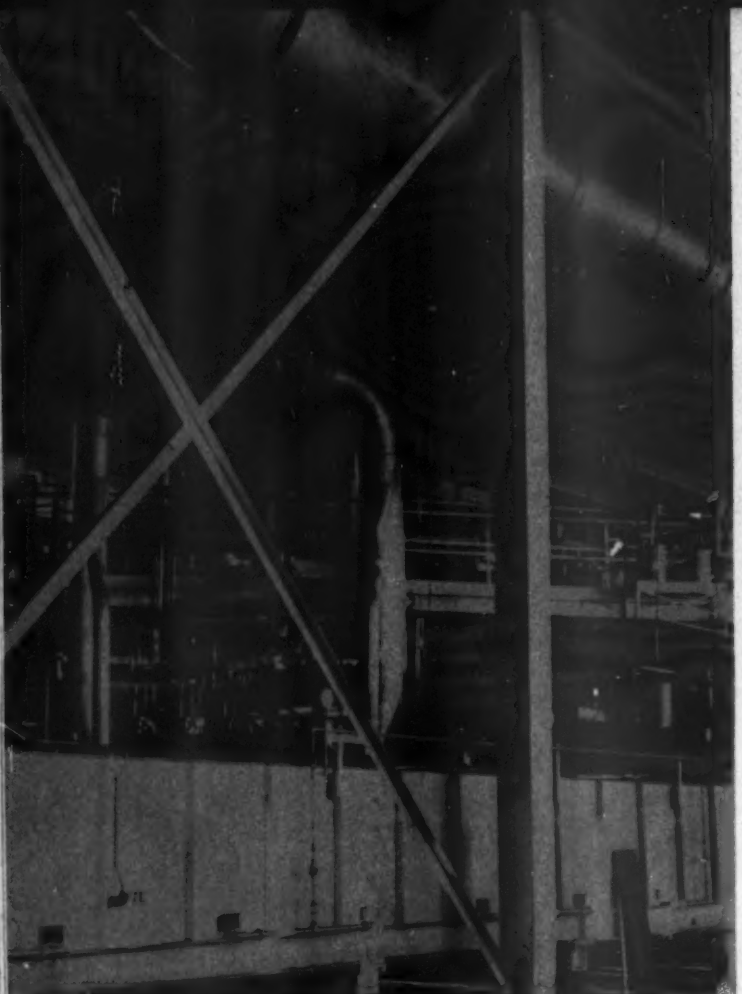
The batch is fed to the furnace in the same manner as at plant Number 2 in Brockway with ten buckets mounted on a monorail line handled manually, carrying the batch to the furnace. The control panel is set behind the furnace. Ample space is provided for free-operation throughout this area. Every effort was made in laying out the plant to avoid any congestion at this point and there is ample room for more than the necessary workmen to operate freely without chance of injury. Every effort has been made to follow this policy at the control board where ample space was allowed on all sides for speedy repair and maintenance.

A wide concrete ramp has been constructed leading from the main floor to the balcony behind the furnace and again from the main floor to the basement. This ramp is twelve feet wide protected by pipe rails. The Clark Trucks used in the boxing department speed up and down these ramps in handling equipment and cullet trucks for the basement. Full lighting of this area can be observed in the aforementioned illustration as can be noted the attention given to construction and placement so as to provide maximum ease of maintenance of equipment at all times.

Construction under the furnace has brick flues above the ground which are eight feet high and six feet across braced with metal strips. Furnace is set on structural steel piers instead of the usual brick piers. Heavy shielded wiring is employed around ventilation fans set in this area with Buffalo Fan Company equipment being used. It can be noted in this illustration how here again

Rear view of Frazier-Simplex batch feeder. Cans moving along return monorail to filling point by hand with hooks.

Under-furnace construction and bracing showing ample room for maintenance and repair.



View from the right of the main production unit showing general plant construction details at this point.

ample space has been provided for maintenance and possible repair work and that built-in ladders are used rather than employing any accident-possible use of portable ladders.

Melting is done in four port siding port firing regenerative tank of the company's own design. The furnace being engineered by the company's own engineering department under the supervision of L. F. Robertson, Chief Engineer. Natural gas is used as a fuel with luminous type of firing. Blaw-Knox air valve is used for furnace reversal. Frazier-Simplex batch feeder is used for sending batch into furnace—the furnace has straight throat. Side walls are Corhart Refractories'—both melting and nose. Bottom blocks are Laclede Christy superflux, both regenerators and cap are insulated with insulated brick.

Equipment for the furnace includes an automatic damper control of Leeds & Northrup make, with this company's temperature controls being used for the furnace and feeders. Bailey air-gas ratio meters are employed.

Furnace at present is equipped with four Hartford-Empire K type forehearths and feeders; four Hartford-Empire 5-Section I.S. Machines; four Hartford-Empire lehrs and stackers. The layout of the furnace nose and floor space provides for the installation of the fifth forming machine unit which will be done within about six months—the fifth unit will also be a 5-Section Hartford-Empire I.S. Machine, together with Hartford feeder, stacker and lehr.

The production line follows standard procedure with glass containers being moved from molds to a continuous belt to the annealing lehrs where Hartford-Empire stackers pick up containers and place them in a lehr where the glass containers are annealed in a period of from three quarters of an hour to one and one-half hours and are selected and packed at the end of the lehr.

As in other Brockway plants the utmost attention has

General plant view from balcony toward front of the plant, furnace to the left.

An Ingersoll-Rand compressor unit driven by 300 hp General Electric motor for compressed air supply.

Special cullet disposal belt unit at the plant for use on crowded assembly line where operator flips bottle to traveling belt above which carries it to the left for dumping in portable cart.

Close up of carton packing operations on one production line showing novel overhead transmission for assembled cartons to packers moving from the left to the overhead belt line down to the right to the girls packing finished ware.

been given to lighting and maintenance. Every area where employes must concentrate on their work is scientifically lighted to meet the requirements of the operation with fluorescent fixtures being used in most spots.

Maintenance is king in plant Number 3 and is a firm policy of Mr. Jacob's plant operation. Oil is kept handy to every operation where needed. Maintenance reminders are judiciously placed, as for example, two cans set near the lehr contain the message on their sides: "Clean paraffin oil is essential to good operation."

Lights are mounted close to operations as shown in the packing operation pictures shown herewith; this is even carried out in the mold repair room and machine shop to which attention is directed to mounts over individual machines as well as in general shop spots.

Carton operations are located on the main floor where some assemblies are made by hand and some by machine where the cartons are stitched or glued. Lamson belt conveyors are used but principal method of movement throughout production lines is in the use of the ever busy motor truck which is used on this operation also.

Cartons are made up just ahead of packing operations and little backlog is kept at present. The making up section is directly adjacent to and in back of the packers' stations and are constantly fed to the four operators. Bostitch stitchers and A-B-C carton sealers are used.

Crowded space in the center line necessitated originating a method for disposal of throw-outs at the packers' location so a unit was perfected which also in figure depicts an ideal station showing the well lighted, roomy and functional features of the position.

This unit consists of a belt driven by a small electric motor through a gear box, set just in front of the operator and slightly overhead. Sorts or broken units are laid on this belt which moves to the right and carries them to the truck shown at the left of the picture. A canvas back behind the unit prevents containers being thrown off the belt or falling aside; a guard rail at front accomplishes the same purpose.

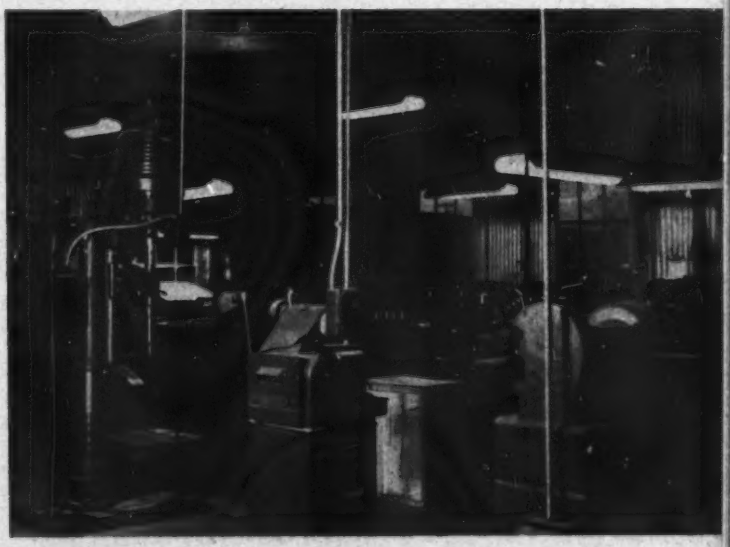
Disposal is arranged on the other lines in the usual manner of having the disposal truck between the metal roller racks which transport the cartons to be filled down the left side and carries them away for stacking and cartage to the warehouse along the right side. Two girls work at this spot on each shift.

To the right of the plant layout an overhead belt system has handled the problem of using the space profitably and at the same time permitting passage through to the plant. The assembler at left places cartons on the belt which carries them to a 24 inch rubberoid belt upon which they move and where they are carried overhead to the right and downward on a chute for the stackers. ABC Packing Machine Company units are used in this area.

The machine shop in plant Number 3 is set to the left of the main floor and is fully equipped with all of the latest types of machine tools and is modeled after the shops at the other plants. Every unit is individually lighted with four tube fluorescent white lights as well as overhead lights and repair benches are near all machines. The shop is 40′ x 50′ in size and is featured by two Monarch lathes; a Gorton duplicator; a Gould and Eberhart shaper, together with several drill presses; small neck ring melting machine; necessary grinders for

(*Continued on page* 630)

A corner of the modern machine shop.



EXPERIMENTS CONCERNING THE REPLACEMENT OF BORIC OXIDE AND LEAD OXIDE IN SOME TECHNICAL GLASSES*

Throughout the German glass literature of the past years we find publications indicating a considerable effort to get along without those materials which had to be imported from other countries. For the glass and enamel industry, boric oxide was the most important one which had to be replaced. Next to boric acid came lead oxide which was widely used as a constituent of glasses in the electric industries. The authors describe the results of extensive research to modify some important technical glass types in order to eliminate B_2O_3 and PbO.

One of the most widely used glass compositions is the "Supremax glass" of Schott and Genossen. Similar glasses were described by H. Partridge. (*Journ. Soc. Glass Technology, 19* (1935) 269). They have in common the use of B_2O_3 and sometimes P_2O_5, as a flux, with low silica content and alumina above 20 per cent.

Typical examples are given as follows:

	I	II	III
	%	%	%
SiO_2	55.7	54.5	51.3
Al_2O_3	23.5	21.0	25.3
B_2O_3	7.0	7.5	1.0
MgO	8.2	...	4.2
CaO	4.6	15.2	8.3
BaO	...	0.8	5.3
Na_2O	0.7	1.3	...
K_2O	0.3	...	...
P_2O_5	...	...	4.6

These glasses are characterized by their high softening points, good thermal resistivity and their resistance against water and weak alkalies. They have poor acid resistance and when reworked in a blow torch, they show a tendency to foam.

It was found possible to develop glasses of similar characteristics by using the eutectic tridymite-anorthite-enstatite as a starting point. This eutectic has the following composition:

SiO_2	61.9%
Al_2O_3	18.5%
MgO	9.4%
CaO	10.2%

Its melting point is 1222° C. The eutectic mixture forms a glass readily, fines easily and its viscosity and working properties resemble closely those of the above mentioned glasses I-III. The glass is suitable for drawing tubes and for blowing both small and large objects. Large scale melts proved that this eutectic homogenizes readily and had little tendency to devitrify. Despite its high content of CaO and MgO it was found to be fairly resistant to diluted acids and much better than the Supremax glass (I). Subjected to autoclave tests with weak alkaline solutions (2 g NaOH in 1000 cc H_2O) it shows a chemical resistivity similar to that of the Supremax glass. The transformation point of the eutectic glass was determined to be 745° C., which is about the same as that of the Supremax glass. Its coefficient of thermal expansion is $38 \times 10^{-7}/°C$.

The complete absence of alkalies makes this glass a valuable electric insulator. At 588° C. its electric resistivity is still 10^8 ohms, a test which places it among the best insulating glasses. On heating in the blow torch it shows some foaming but can still be worked without difficulties. Further studies revealed that the quarternary system silica-alumina-lime-magnesia contains a number of valuable glass compositions, the limits of which were given as follows:

	%	%
SiO_2	77.0	44.7
Al_2O_3	16.4	13.4
MgO	3.3	6.8
CaO	3.3	35.1

From the possible modifications of the eutectic, glasses containing alkali and barium were of particular interest. The eutectic glass can be sealed with tungsten. Increasing its silica content and introducing alkalies produces a glass suitable for sealing with molybdenum. Its thermal expansion was thus raised to $50 \times 10^{-7}/°$ C. Additions of BaO further improved their electrical insulating qualities. The following examples were given:

	IV	V
	%	%
SiO_2	67.4	69.0
Al_2O_3	13.6	10.0
MgO	6.9	2.0
CaO	7.5	12.0
BaO	...	3.5
Na_2O	3.6	0.8
K_2O	1.0	2.7

In the eutectic and its variations the divalent oxides of calcium, magnesium and barium play a role similar to the boric acid in the Supremax glass. CaO and MgO in those low silica glasses exert a similar influence upon the viscosity as boric acid; as substitutes of silica they increase the low temperature viscosity.

Zinc oxide has been found to be another valuable constituent of this type of glasses for which VI and VII are given as two examples.

	VI	VII
	%	%
SiO_2	72.5	68.5
Al_2O_3	4.5	10.0
MgO	1.5	0.0
CaO	2.5	6.0
BaO	4.0	4.0
ZnO	6.0	4.0
Na_2O	6.0	7.5
K_2O	3.0	0.0

The work indicates that it was possible to melt glasses

(*Continued on page* 626)

SCALE GLASS AS A SUBSTITUTE FOR MICA*

By J. M. STEVELS

Summary

In the following some details are communicated concerning a new product which has been developed† originally with the aim of having a substitute for mica in radio valves. The product is composed of glass scales and fulfills all the essential conditions required for such a substitute. In addition it has some properties which may be valuable for other applications.

1. Principles of preparation. It is a well known fact that two glass plates which are optically flat can cohere so perfectly that they cannot be separated. The same must be possible if the plates are so thin and so flexible that on cohering they are able to follow each other's external boundaries. Starting with a large number of glass scales a thick plate may be built up which may be expected to be sufficiently strong and yet flexible enough to fulfill the conditions required for a substitute for mica in radio valves and in other applications.

We have found that such plates can be built up rather easily in the following way: if a large number of tiny glass scales are placed in a suitable medium, the scales are surrounded by an electric double layer. As a consequence the scales repel one another and are kept at some distance apart. The influence of gravity makes them settle and the double layer repulsion effects a parallel orientation of the scales at the end of the sedimentation, so that in the final state all the scales lie parallel to each other. If the medium is now removed, the scales sink together and form the required plate by their mutual van der Waals attraction.

2. Requirements for the product. Mica is used in radio valves to fix the electrodes in the required positions and to insulate them from each other. It is a very good material for this purpose, since it has a number of favourable mechanical properties. It is sufficiently strong, it can be split and punched very easily, which is of great importance for fabrication. It is flexible and has the property that an electrode stuck into the material is held rather firmly, but nevertheless remains movable.

The electrical properties of mica as an insulator are also excellent. It has a low electrical conductivity, small dielectric losses ($\tan \delta = 1 \times 10^{-4}$) and a rather high dielectric constant ($\varepsilon = 6$). Mica does not decompose below 700°C. Its thermal conductivity parallel to the cleavage plane is 0.011 cal/degree cm sec, perpendicular to this plane it is 0.001 cal/degree cm sec.

Obviously, the substitute should have about the same properties. In sections 3—6 incl. of this paper a description is given of how sheets having the required properties can be made; in section 7 the material (which is called scale glass) is compared with mica. In section 8 a number of applications are listed.

3. General theoretical remarks. In asking the question of what are the ideal circumstances for the formation of the plates we must distinguish two phases:

A. The scales are still gliding in the liquid. In order to prevent flocculation it is necessary that the interaction potential of the electric double layer surrounding each scale, as a function of the distance, be developed in such a way that, together with the potential of the van der Waals forces, a potential barrier is formed sufficiently large compared with the energy of the brownian movement of the particles[1]. Generally speaking, this is not the case for liquids with a small dissociating power. Here flocculation with a large sedimentation volume occurs, since the component particles are oriented in all directions. This is the case with glass scales in nitrobenzene, benzene and carbon tetrachloride.

B. If the flocculation does not occur, the scales will settle in more or less parallel positions due to their mutual repulsion, so that a very dense arrangement is obtained. These sedimentations are characterized by a very small volume. Since in this case a number of scales are piled up on each other, the potential of gravity begins to play a role. Generally speaking, this potential decreases the potential barrier mentioned above, so that the repulsion due to the double layer has to be stronger now in order to prevent flocculation. A commercial lead glass (containing about 57% SiO_2, 29% PbO, 7% Na_2O, 5% K_2O and 2% Al_2O_3) gives scales, which do not show flocculation in distilled water or in propanone. Sedimentation, however, takes place rather rapidly, while at many places the parallel arrangement is not realised. If the liquid is now removed a plate of inferior quality is obtained. This disadvantage can be anticipated by giving the scales a sufficient double layer, in other words by giving the liquid a suitable p_H. In the case of the lead glass mentioned above the best orientation of the scales is obtained for $p_H = 8.2$ and $p_H = 1.2$; for these values plates of the highest quality are obtained. This means that the isoelectric point of the glass lies between these two values, somewhere near $p_H = 4.7$.

It is a well known fact that suspensions become stable when their p_H has a value sufficiently different from that at the isoelectric point[2]. In this case, this difference amounts to 3.5 p_H units, which means that the particles of the suspension are stabilized by a double layer of the order of 0.2 volt. The values $p_H = 8.2$ and 1.2, respectively are obtained by the addition of a suitable quantity of a solution of NH_3 or HCl. Since in the former case much less electrolyte is present, this method of preparing the plate must be preferred, as the electrolyte has to be removed completely afterwards. The most favourable p_H value for each kind of glass can be determined by stirring the various suspensions. These show the lowest viscosity in their most stable state. In fact, it is found that a suspension of scales of the above-mentioned glass in water shows a minimum of mechanical resistance for $p_H = 8.2$ and $p_H = 1.2$

The isoelectric points of most other glasses lie so low that water with an arbitrary value of p_H between 2 and 12 gives rise to a sufficient double layer. In this case electrolyte-free water must be preferred, and actually the best plates are formed by using distilled water as medium.

4. Influence of the thickness of the scales. The thickness of the scales is of great importance. If they are

*Reprinted from Philips Research Reports, N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands.

†By Dr. J. H. Gisolf and the author.

obtained by blowing out glass bulbs, they will not be quite flat. For this reason they must be so thin, that they can be deformed rather easily by the force of cohesion (possibly combined with the pressure due to their weight), so that they can adhere to other scales over their whole surface. In practice we find that the scales must have a thickness of the order of 1 to 5 μ. Only in this case are compact strong plates obtained.

Starting with scales of about 25 μ a product is obtained with a much looser structure.

5. Preliminary experiments. Originally the plates were prepared from scales of the above mentioned lead glass. The scales were cleaned by washing with 1% solution of HF, then with concentrated HCl and distilled water. When the suspension is evaporated to dryness plates are obtained which show coherence and which can be punched. The treatment with HCl is essential; without it plates of an inferior quality are obtained[3].

The preparation was considerably simplified by removing the medium by suction on a suction funnel. In this way several hundreds of different plates were made; during this investigation the following results were obtained:

a) The resulting plates are better, the more suitable media are used. Media with a weak dissociating power give rise to a badly developed double layer. Already in the suspension the van der Waals forces give rise to flocculation (for instance in the case of the above-mentioned lead glass in nitrobenzene, benzene and carbon tetrachloride).

b) For this special lead glass the best results are obtained in water with $p_H = 8.2$ or 7.2. As mentioned above, suspensions with these values for p_H are characterized by a minimum viscosity.

c) All other glasses investigated and also quartz are so "negative" that distilled water can be used with success. This has the advantage that after drying there are no electrolytic impurities in the plates.

d) The quality of the resulting plate depends on the medium used. The most stable suspension gives the best plates. The sequence for the glass scales investigated is water, methanol, propanone.

e) It is found that, generally speaking, a larger potential difference due to the double layer ($\pm$0.2 V) is necessary than in the case of the real suspensions ($\pm$0.1—0.12 V) in order to prevent flocculation.

The most favourable electrolyte concentrations will therefore depend on the size, the thickness and the specific density of the scales, the van der Waals forces between the particles and the properties of the medium.

f) The influence of additions to the medium on the properties of the plates obtained was investigated.

By adding 1% potassium-silicate solution of a specific density 1.3 to the medium, plates are formed which are much stronger, but also more brittle. Bridges between the scales probably come into existence and give rise to these new properties.

Using ethanol as medium 1% ammoniacal phenolaldehyde resin can be added, which produces very hard plates after heating to 100°C.

If propanone is used as medium the methyl ester of polymetacrylic acid (trade mark "Diakon") can be added in various quantities and the plates obtained are hard and only slightly brittle after drying at 50°C. Obviously, plates obtained in this and in the previous way, cannot be used in radio valves, since they cannot be treated in vacuo to 400°C.

The influence of phosphoric acid was also extensively investigated. By adding 10% of this compound to the medium (in this case water) very flexible, parchment-like plates are obtained, which can even be folded, but which, however, loose their rigidity above 400°C. The most suitable combination of phosphoric acid and potassium silicate for the application in radio valves was sought, and as a result of a systematic investigation it can be stated that the best results are obtained by adding 0.5% of phosphoric acid and 0.2% of potassium silicate to the water.

6. The preparation of scale glass plates in practice. After the considerations in the preceding sections we may give practical directions for the preparation of scale glass plates of good quality from scales of almost all compositions.

The scales can be obtained in large quantities by the following process. The glass is fused and drawn through a slit of 4 mm width with a length of about 100 mm. At both ends the slit ends in a circular hole with a diameter of about 10 mm. The glass drawn from this dumb-bell shaped slit emerges as a membrane suspended between two rods. When the glass is cooled, the rods are removed by cutting. The remaining membrane is very easily broken up into small particles which are used as raw material for the production of the scale glass.

Glass scales with a thickness of about 1 μ and a surface of about 1 mm^2 are placed in distilled water to which a little phosphoric acid and potassium silicate (according to section 5f) is added. The scales are given some time to settle in the suction funnel before the suction is applied. A wet slimy plate results. The settling of this plate can be helped by rubbing it lightly.

When the plate is sucked thoroughly dry, it is still deformable: it can now be given any arbitrary form. After drying the resulting plate at 80°C for an hour, it remains fixed in its ultimate form.

For use in radio valves, drying at 80°C is not sufficient. Upon evacuating the valve a quantity of enclosed water escapes from the plate and this may give rise to an explosive shattering of the plate. For this purpose it is necessary to heat to 200°C, if possible under light pressure. For instance a pressure of about 20 kg/cm^2 improves the quality of the plate somewhat, but not very much. Much higher pressures, however, (for instance of the order of 200 kg/cm^2 cannot be used, since the plates are then demolished. For the use in radio valves it is of some use to cover the plates with a thin layer of SiO_2 by spraying with a solution of ethyl silicate in a water-methanol mixture.

Following the method given, it is possible to produce scale-glass plates of hard glass (containing only SiO_2, B_2O_3 and Al_2O_3) which can compete in all respects with mica in radio valves. Valves equipped with plates of 0.5 mm could be subjected to shock for 6 hours and could be dropped on the floor without the occurrence of breaks.

Hard glass is used by preference, since otherwise the glass may fuse slightly around the cathode during its formation.

7. Comparison of the properties of mica and scale glass. The properties of mica and scale glass are compared in the following table:

(*Continued on page* 628)

THE APPLICATION OF LOW FREQUENCY SPECTRA TO GLASS TECHNOLOGY

In the last issue of the *Bulletin de l'Institute de Verre*, monthly publication of the French Glass Institute, Pierre Girard, director of the Institute of Physicochemical Biology and Paul Abadie, Chief Engineer of the National Laboratory of Radioelectricity, call the attention of glass technologists to the significance of low frequency spectra gained by measuring the power loss at wave lengths from 1 m to 1,000,000 m.

For small wave lengths, i.e. high frequencies approaching those of visible light, the dielectric constant is small, constant, and equal to the square of the refractive index. It corresponds to the polarization within the molecule: displacement of electrons in the atoms, atoms in the molecule.

For increasing wave lengths the dielectric constant passes through an area of steadily increasing values (ϵ') corresponding to the polarization of molecules or structural units until, at a certain wave length, for complete polarization, a stable and high dielectric constant is reached.

In this area, in an alternating field, the retardations of polar groups in following the alternations of the field, are accompanied by a dielectric loss (ϵ'') which is variable with wave length.

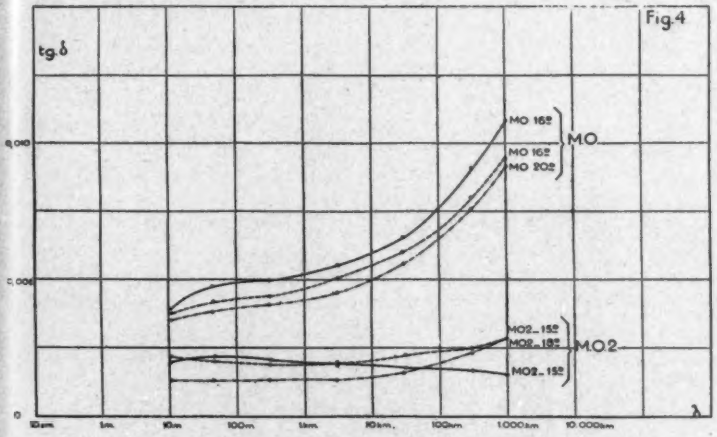


Fig. 2

For symmetrical molecules, of equal shape and size, equal dipole moment and relaxation time, Debye has calculated the variations of dielectric losses with frequency.

In real, particularly colloidal and polymerized, materials the observed values deviate considerably from this theory. These deviations were used by the authors to interpret the structure and to predict the performance of materials.

The analysis of Girard and Abadie, as applied to industrial products, is concerned with the significant variations of the loss angle (tan $\delta = \epsilon''/\epsilon'$) with wave length which they call low frequency spectra.

With rubber, there was found to exist a direct correlation between such "spectra" and resistance to rupture, tearing strength, etc.

Fig. 1 (fig. 3 of the original paper) shows such "spectra" that is the variation of the tangents of the loss angle, tan $\delta = \epsilon''/\epsilon'$, with wave lengths from 10 to 1,000,000 meters for five rubbers, A, B, C, D, E.

A, B, E have good resistance toward rupture (180 kg/cm²). The uniformity of dielectric loss is explained as small variation of relaxation time of various dipoles present in similar concentration. D has excellent resistance. The high values of tan δ between 1,000 and 1,000,000 m are interpreted as a high concentration of long and very long polar chains.

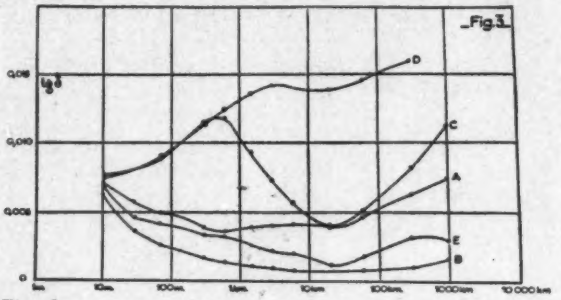


Fig. 1

C has bad strength characteristics. The curve is believed to indicate two groups distinguished by relaxation times of considerable difference.

The evidence pertaining to glass is more suggestive than conclusive.

Glasses of different composition, dried with equal care, exhibit considerable variations of low frequency spectra. (Fig. 2, 3) (4 and 5 of original). Unfortunately, compositions are not known. In most cases one type of relaxation time became evident and was believed

(*Continued on page* 624)

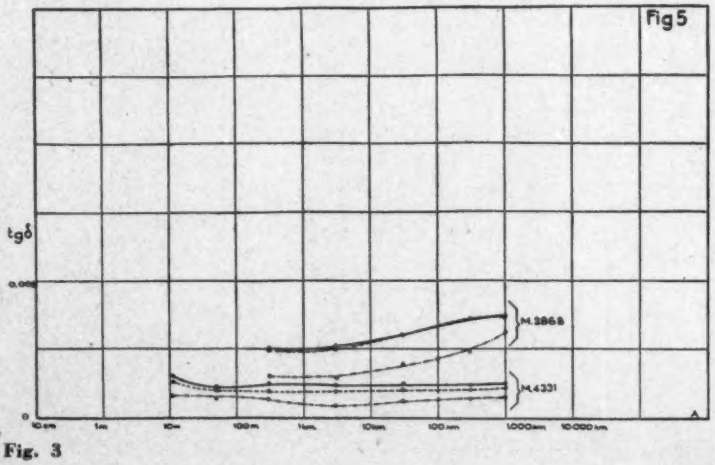


Fig. 3

HAROLD SIMPSON TO HEAD GLASS TECHNOLOGY AT ALFRED

Dr. Harold E. Simpson has been appointed head of the glass technology department at the New York State College of Ceramics at Alfred University to succeed Dr. S. R. Scholes. Dr. Scholes was appointed Dean of the College recently and had previously headed the glass technology department since 1932.

Since 1942, Dr. Simpson has been industrial fellow for the Mississippi Glass Company at Mellon Institute. This work was related to the development of rolled glass products for fenestral and structural purposes. He has developed new glasses, investigated batch material, studied wire netting for wire glass and studied methods of finishing and decorating such products. Prior to that, Dr. Simpson had been an industrial fellow for the Pittsburgh Plate Glass Company at Mellon Institute and had also been an industrial fellow for the United States Gypsum Company.

Dr. Simpson was graduated from Ohio State University with the degree of B. Cer. E. in 1925. The following year he was appointed fellow in the U. S. Bureau of Mines at the Engineering Experiment Station, Ohio State University. He received his M.S. degree in 1926 and devoted the next three years to post graduate study of glasses and enamels with special reference to various eutectic formations. He received the Ph.D. degree in 1929.

Later appointed professor of ceramics and research assocate in the ceramics department at Rutgers University, Dr. Simpson joined the staff of the Battelle Memorial Institute in 1930 as research engineer. He received the professional degree of Ceramic Engineer from Ohio State University in 1938. He has been a member of the American Ceramic Society since 1924 and is also a charter member of the Institute of Ceramic Engineers.

REPORTS AVAILABLE THROUGH DEPARTMENT OF COMMERCE

Large-scale production of optical lenses without grinding or polishing may be possible by use of glass molding technique developed during the war and is described in an American research report (PB-28634) now on sale by the Office of Technical Services, Department of Commerce. This is a 63-page report written by research workers of the Eastman Kodak Company.

Also released by the Department, is a report (PB-34809) on a new synthetic material, artificial sillimanite, which has replaced Indian kyanite in the manufacture of mullite refractories in Germany during the war. The report was prepared by G. W. Josephson of the Joint Intelligence Objectives Agency and describes the ingredients of the substitute and the method used by the Heinrich Koppers Corporation of Dusseldorf in preparing it.

LECTURE SERIES TO BE GIVEN BY DR. TURNER

A series of special lectures in Glass Technology is being given in the Department of Ceramic Engineering at the University of Illinois by Dr. W. E. S. Turner, Visiting Professor of Glass Technology.

The lectures will be of two general types: one consisting of "The Historical Survey of the Art and Science of Glass" and the other, "The Recent Developments in Glass Technology." The topics presented in the latter series will include "The Vitreous State," the approach from the low temperature level; "The Transmission of Radiation Through Glass"; "The Mechanical Strength of Glass"; and "Developments in Glass Melting Furnaces" (including the electrical melting of glass).

While the lectures are designed primarily for the advanced undergraduates and graduate students of the Department of Ceramic Engineering, staff members and graduate students from other departments have been invited to attend.

TOLEDO FOOTBALL FIELD FEATURES GLASS MOTIF

The University of Toledo Glass Bowl, utilizing the latest in glass design and materials, will be the scene of the nation's first post-season grid classic on December 7. It will be the first annual Glass Bowl game.

Three Toledo glass companies, incorporating an idea conceived by Wayne Kohn and John Biggers, President of the Libbey-Owens-Ford Glass Company, will cooperate with University officials in the renovating of the Bowl into a modern football plant with glass as the featured motif. Although the complete renovating process will continue over a period of years, a great many improvements will be in evidence at the December 7 game.

The proposed press box facilities will be an outstanding feature of the Bowl. Its construction of glass block, acoustical tile and thermopane windows will include two floors and an upper deck for taking moving pictures. The first floor of the press box is expected to be completed in due time for the Bowl game this season.

A modern score board, which is expected to measure 22′ x 12′, is under construction, and a huge arrow-like illuminated sign located on West Bancroft Street will point the way to the Glass Bowl.

A.C.S. SECTIONS HOLD MEETINGS

The Trenton Section of the American Ceramic Society held its second meeting of the year recently. Samuel Hibben, Westinghouse Electric Corporation, was speaker of the evening and spoke on "New Methods of Producing Light."

In his opinion, the wide variety of possibilities for fluorescent lamps, heretofore generally restricted to providing light, have never been fully understood or exploited. He discussed and demonstrated interesting new uses for this and other types of light.

The December meeting of the Pittsburgh Section of the American Ceramic Society is scheduled for December 10 and it has been announced that Walter Emerson, Chief Engineer of the Homer Laughlin China Company, will be guest speaker. Mr. Emerson's subject is "Mechanization in the Whiteware Industry."

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Feeding and Forming

Patent No. 2,410,422 is an invention by George A. Breene and Louis D. Garratt, both of New Castle, Pa. The invention relates to the construction and surface treatment of blank molds on a press and blow machine and it has been applied to the Hartford-Empire milk bottle machine with excellent results. A novel valve mechanism is provided which cooperates with a spray which coats the mold cavity with colloidal graphite suspended in oil.

Fig. 1 is a section through the blank mold of the Hartford-Empire machine. A mold 11 has a cavity 12 shaped for use in making milk bottles. Fins 13 are provided and the usual cooling wind may be used. A valve 16 in the bottom of the mold has a stem 17 and a head 18 below the mold cavity. This head is positioned in a chamber 15. The head 18 rests on a valve 21 having a stem projecting through the table 30 which is engaged and lifted as the table rotates by a cam 29. The valve stem 17 is lifted in the usual manner to raise the parison prior to transfer and after the transfer, the cam 29 lifts the valve so that grooves 28 form a vent from the mold cavity to atmosphere through holes 31. At this time, while the mold cavity is vented, a spray head 32 discharges air or oil carrying graphite into the mold. Such an arrangement is shown in a patent to Garratt, No. 2,246,463. With the construction of the present invention, such a blast does not build up pressure in the mold but, instead, allows the lubricating mixture to coat the whole of the mold cavity.

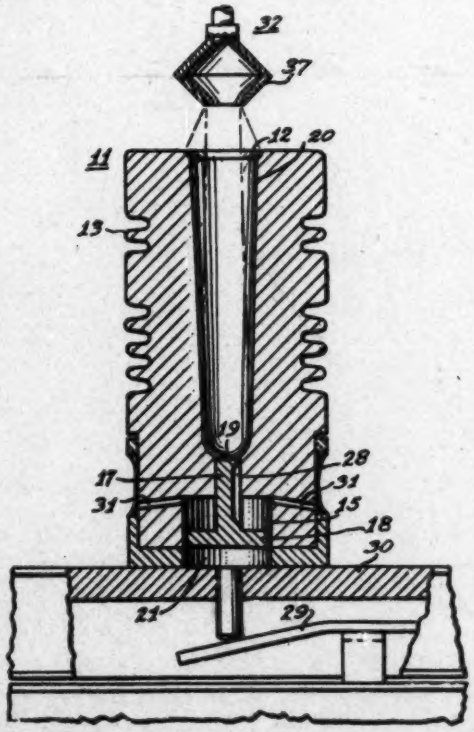
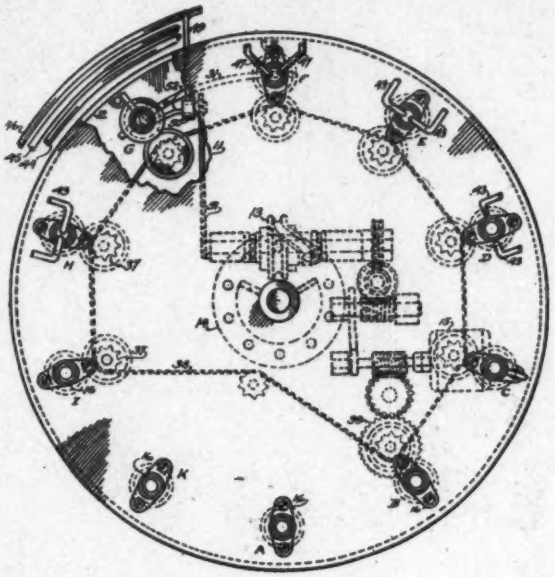


Fig. 1. Mold Construction



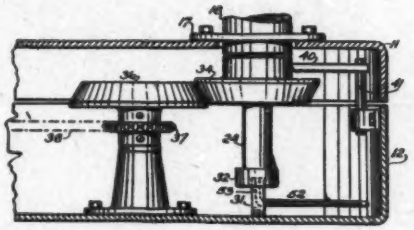


Fig. 2. Drive for Forming Machine

This invention has increased the production of one-pound Spry bottles on the Hartford machine from 328 gross to 452 gross every twenty-four hours. It also gives a big saving in mold up-keep.

Patent No. 2,409,423 discloses a driving means for turret type forming machines in which the heads are rotated at certain stations and held stationary at other stations. It is an invention of Charles Eisler of South Orange, New Jersey. This patent was divided from an application filed January 20, 1944.

The invention may be used on machines for performing various operations on the glass, but as shown in Fig. 2, a spider 11 is mounted for rotation on a base 12 and carries ten working heads indicated by the letters A to K which move successively to ten work stations. The machine is shown as arranged to perform a series of operations on electronic tubes. The spider is indexed step by step by a cam 13 driven by a motor 15.

The lower end of each head 16 carries a cone 34 which is capable of vertical movement with respect to the head. When the rotation of the head is to be stopped, a finger 40 projecting from the cone engages a stop 41. Unless the head is held from rotation in this way, it is driven by one of the cones 36 there being one of

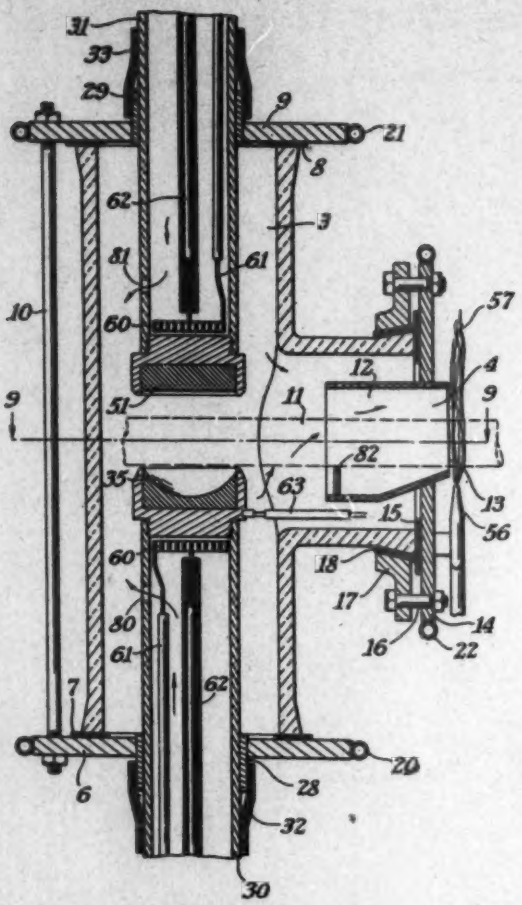


Fig. 3. Lens Molding Machine

these driving cones at each station where the head is to rotate. The cones 36 are driven continuously through sprockets 37 and a chain 38. The chain is driven by gearing 39 from the motor 15. When the driven cone 34 is stopped, it lifts slightly. When the finger 40 releases the cone, it is moved into driving engagement with the cone 36 by gravity.

The patent shows various connections as at 24, 31, 52, etc., for operating the tools which work upon the electronic tubes, but these form no part of this invention. It may be assumed that these will form the subject matter of the patent to issue on the original application from which this patent was divided.

Patent No. 2,410,616 on a lens molding machine was assigned to Eastman Kodak Company by the inventor, Julian H. Webb.

While it has been the practice in the past to make lenses by pressing, such lenses have never had the highly accurate surface which is called a "spectacle finish." Therefore, grinding and polishing were always necessary for a high grade product.

As molds have to be used at quite high temperatures, the molding surfaces rapidly become oxidized from exposure to the atmosphere. This invention provides a machine in which the molding takes place in an inert or reducing atmosphere, thus preventing oxidation of the mold surfaces but, at the same time, in full view of the operator.

Fig. 3 is a section through the working parts of the machine. An enclosed molding chamber 3 is preferably made of Pyrex glass and has an opening 4. This chamber is held between a bottom plate 6 and a top plate 9 provided with gaskets 7 and 8 and held together by bolts 10. The glass 11 is introduced through a tube 12 having a small opening 13 held in a plate 14. Cooling water is provided for the plates 6, 9 and 14 by pipes 20, 21 and 22.

Tubes 30 and 31 pass through the upper and lower plates 6 and 9 and the lower tube 30 carries a mold 35. This mold is in a fixed position. The upper tube carries a die 51 movable toward and from the mold 35. An inert or reducing gas, such as hydrogen, is supplied to the tubes 30 and 31 and fills the chamber 3 as shown by the arrows. Hydrogen is burned as it comes out of the opening 13 and an air jet 56 provides a curtain of flame 57 across the opening. This prevents air from entering the opening.

Both the lower mold 35 and the upper mold 51 are heated by Nichrome ribbons 60 connected to a suitable source of current. The temperature of the mold 35 is automatically controlled from a thermocouple 63. By this arrangement, the operator can insert a rod of glass (or other plastic material) into the chamber for pressing in an inert atmosphere, observe the pressing operating and withdraw the pressed form still attached to the rod. At the same time, he obtains a better product and greatly prolongs the useful life of the molds.

Glass Compositions

Patent No. 2,410,286 was assigned to Corning Glass Works by Harrison P. Hood. It relates to a glass especially useful in making parts for radio broadcasting and receiving apparatus where it is essential that the

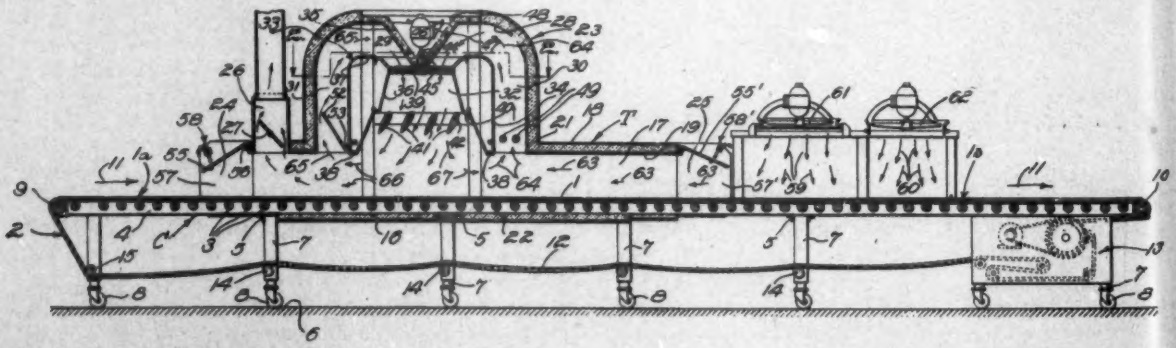


Fig. 4. Hartford-Empire Ware Drier

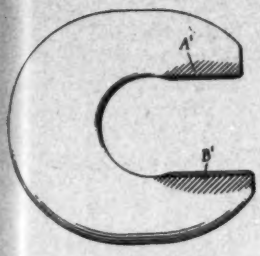


Fig. 5. Tempered Glass Gauge.

glass have a low power factor. Such glass must also be capable of being sealed to other glasses and to metal.

This glass improves upon that described in an earlier patent, No. 2,072,207, also invented by Mr. Hood. The new composition provides a glass having a power factor of about 0.0004 with a silica content of about 70 per cent. This result is obtained by the substitution of potassium, in whole or in part, for the sodium formerly used.

The following eight examples of this new batch are given in weight percentages on the oxide basis:

	1	2	3	4	5	6	7	8
Sand	350	305	350	350	350	350	350	350
H_3BO_3	212	310	...	212	...	230	244	235
K_2CO_3 (85%)	53	26	...	...	...	...	...	...
KNO_3	...	11	43	...	32	...	...	19
B_2O_3	...	...	130	...	130	...	...	...
K_2SiF_6	...	...	...	70	10	47	30	...
Na_2SiF_6	...	...	...	...	...	...	...	26

The power factors of these examples are as follows, it being noted that the fluorine which is found in the resultant glass made from examples 4 to 8 has been omitted as a matter of convenience.

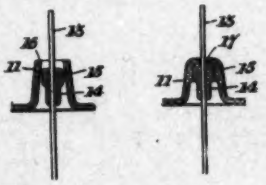


Fig. 6. Vacuum Tube Lead-in Seal.

	1	2	3	4	5	6	7	8
SiO_2	70	61	70	70	70	70	70	70
B_2O_3	24	35	26	24	26	26	27.5	26.5
K_2O	6	4	4	6	4	4	2.5	1.75
Na_2O	...	...	...	...	...	...	...	1.75
Power factor	.00095	.0006	.00055	.0006	.00038	.00033	.00036	.00042

Miscellaneous Processes

Patent No. 2,409,298 was assigned to Hartford-Empire Company by Donald G. Merrill. This patent is for drying decorations applied to glassware before the decorations are fired.

Fig. 4 is a longitudinal section through the drier which resembles a short well-ventilated lehr. A tunnel T has a conveyor 2 passing through supported by rollers 3 supported on a frame having legs 7 and casters 8. The casters permit the drier to be moved readily on a floor 6. The conveyor which is of the usual woven wire type is driven by a motor and a drive mechanism 13.

The tunnel T has a bottom 16 below the conveyor rollers and a top 18 which, it is suggested, may be of heat insulating material. A hood 23 is formed on the top of the tunnel and an exhaust flue 26 is also provided. A damper 27 adjusts the effective area of the flue. The hood provides a mixing space 29 and uptake passages 30 and 31. Air is drawn upwardly through these passages and returned to the tunnel through a central passage 32. A fan 39 draws air upwardly from the tunnel through the two uptake passages and returns it to the tunnel through the central passage 32. Vanes 41 are individually adjustable and may be set to direct the air in either or both directions or to shut off the air. As shown, they are set to deflect the air toward the incoming ware which enters in the direction of the arrow 11. The air passing upwardly through the passage 30 is heated by burners 39. A damper 52 is adjustable to control the amount of air drawn from the loading end of the drier. Doors 55 at the front and 55' at the rear of the tunnel are the same as usually found on lehrs. The usual loading and unloading tables are also provided at the front and back of the tunnel. The ware is cooled to permit ready handling before it reaches the unloading table by fans 61 and 62. If this final cooling is not needed, it may be omitted or dispensed with.

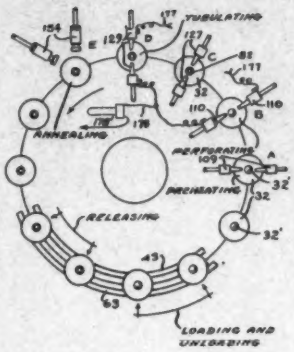


Fig. 7. Corning Perforating and Tabulating Machine.

In brief, the dryer draws cool air into the discharge end and then heats this air and returns any desired part of it to the tunnel. The numerous arrows in the figure show the air currents. The dryer is successful without heating the ware more than 300 to 500° F.

Patent No. 2,409,864 is on a tempered glass gauge, such as a snap gauge. It was assigned to Blue Ridge Glass Corporation by R. J. A. Ingouf and J. H. Lewis.

The inventors make use of the well-known hardness of tempered glass and in order to permit the working surfaces of the gauge to be finished to accurate dimensions, these portions of the gauge are not tempered but left in an annealed condition. The portion to be left in annealed condition may be covered with a mask during chilling or the application of heat may be controlled. Both of these methods are described in Patent No. 2,244,715 to Bernard Long.

A snap gauge is shown in Fig. 5 where the shaded portions A^1 and B^1 indicate the untempered parts. The working surfaces may be brought to accurate dimensions by grinding which, it is said, could not be done without damage if these portions were tempered. The use of the invention is not limited to snap gauges, but could be applied to any glass article where strength and hardness are desired but where certain working or critical points must be finished to exact dimensions.

Patent No. 2,410,061 is on a lead-in seal for vacuum tubes and it was assigned to Federal Telephone and Radio Corporation by the inventor, Lynn C. Goodale.

It has been found desirable to make the connection between the tube base and the lead-in conductor, especially if the conductor is tungsten, in the form of a projecting cone or skirt depending from the seal.

Fig. 6 shows an extension 11 projecting from a tube base. A tungsten lead-in conductor 13 is first provided with a glass bead 14 having an enlarged end 15. The lead-in and bead are then positioned inside the extension or flare 11 with the enlarged end slightly below the top 16 of the flare.

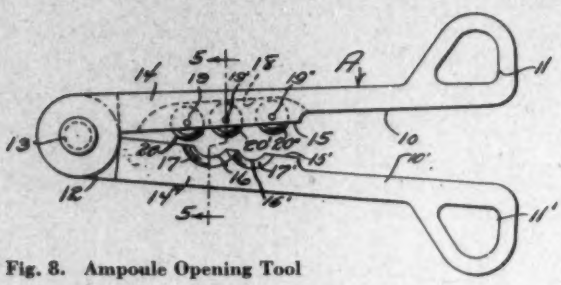


Fig. 8. Ampoule Opening Tool

The top of the flare is then heated so that the soft glass seals to the conductor 15 and to the enlarged end 15 of the bead as shown in the right of the figure, forming an invert as shown at 17.

Patent No. 2,410,345 is on a machine for perforating the bottom of a bowl and attaching a tube to make the upper bowl of a vacuum coffee maker. It is the invention of Ray A. Hinkley who assigned it to Corning Glass Works.

The former method of doing this job was to heat a small area in the bottom of a bowl, perforate the heated area and then to seal a tube to the opening. This operation was largely manual and considerable time and skill was required. This machine automatically performs these operations.

Fig. 7 is a general diagram of the machine which requires seven sheets of drawings for complete disclosure in the patent. The machine is of the turret type having twelve heads each having bowl and tube chucks in vertical alignment. The bowls 32 are placed open end down on the chucks at the right of the two stations marked "Loading and Unloading." Each chuck, moving in a counter-clockwise direction, then moves to at least one preheating station where the area to which the tube is to be attached is softened. This is done by burners 109, 127 and 154. At position A, the burners 109 apply intense heat to the bulge 32^1 on the bowl.

At position B, combined burners and electrodes 110 burn off the bulge while it is being pulled upwardly. At position C, burners 127 apply heat to the edge of the opening left by the removal of the bulge. At the same time, another pair of burners heat the bottom of the tube which is positioned directly above the bowl.

At position D, burner-electrodes 129 fuse the tube to the bowl. The use of high frequency current in the burner-electrodes may be as described by E. M. Guyer in an article entitled "High Frequency Electric Glass Welding" published in Volume 79, 1941, Transactions of the Electrochemical Society. The burners 154 at station E are for annealing the seal.

The finished product is released and unloaded at the stations indicated in the drawing. Various mechanisms are provided for revolving the work at certain stations, for supplying air pressure to the interior of the bowl, for disposing of the cullet and for other operations to make the machine completely automatic.

Patent No. 2,410,901 is on a tool for opening glass ampoules and it was invented by Jesse J. Ramsey of Cairo, Illinois. It is said to be much safer and quicker than notching the glass with a file as is usually done.

As shown in Fig. 8, the device comprises a pair of handles 10 and 10^1 pivoted together at 13 and provided with finger holes 11 and 11^1. The lower arm 10^1 is provided with semi-circular notches 16 and 16^1 of a size to receive ampoules of different diameters. On the arm opposite these notches are three cutting wheels 20, 20^1 and 20^{11} arranged so that two of these wheels will engage an ampoule positioned in either notch.

When the tool is closed on an ampoule, a half turn will quickly sever the ampoule leaving a clean cut.

Patent No. 2,410,931 to Charles Eisler of South Orange, New Jersey, is for cutting or cracking off glass tubes and it is particularly adapted for use in the manufacture of tubes for fluorescent lighting. A machine for this purpose must not damage the fluorescent lining and must produce a smooth end on the tube. The machine employs a hot wire cracking method in combination with a special cracking knife.

Fig. 9 is an end view of the machine which comprises a base 5 leaving a top 7 supporting a pair of frames 8, there being a similar frame on the opposite end of the top. The frames carry bearings for three spindles 16, 17 and 18 and each spindle carries a pair of rollers 19, 20 and 21 which form supports for the glass tubes 22 and 23. The spindles and rollers are driven by a motor 24 through a speed-reduction unit

(*Continued on page* 624)

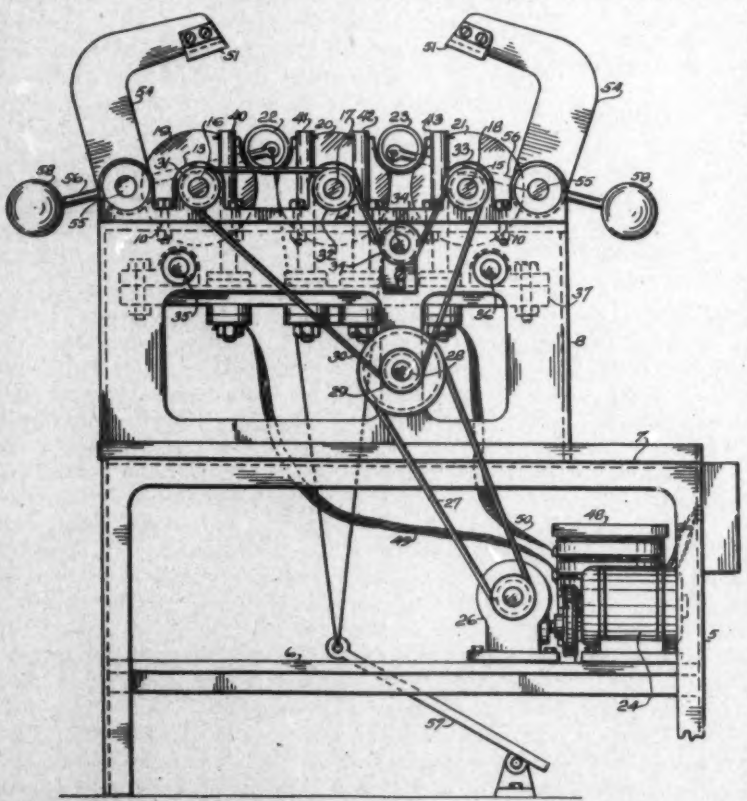


Fig. 9. Tube Cutting Machine

Research Digest

The Viscosity of Some Glasses in the Annealing Range

It has long been known that the viscosity of a soda-lime-silica glass is dependent upon the heat treatment it receives in the viscosity range 10^{10}-10^{13} poises. Dale and Stanworth *(Journal of the Society of Glass Technology*, December 1945) thought that heat treatment might have a markedly different effect on the viscosity of borosilicate glass and the present report is the result of an investigation undertaken to test this possibility.

The viscosity measurements were made on threads of glass about 10 cm. long and 1 mm. diameter drawn down from rod in a blow-pipe flame. The threads were maintained at constant temperature in a vertical tubular furnace, the viscosity being determined by loading the fibre and measuring the rate of elongation. Three glasses were used, the composition of which are as follows: C19; SiO_2 72, Al_2O_3 1.0, MgO, CaO, BaO 9.4, Na_2O, K_2O 17.3. C9; SiO_2 74.6, B_2O_3 18.0, Al_2O_3 1.0, MgO, CaO, BaO 0.3, Na_2O, K_2O 5.9, C40; SiO_2 66, B_2O_3 24, Al_2O_3 2.0, Na_2O, K_2O 8.0.

From the results obtained, it was concluded that in the range 10^{11}-10^{13} poises, whereas the viscosities of soda-lime-silica glasses rapidly approach equilibrium values, those of some borosilicate glasses take considerable time to become stabilized. The viscous properties of these boro-silicate glasses when stabilized, however, are closely similar to those of the soda-lime-silica glasses.

The authors speculate on the possible reasons for the above phenomena. The changes during stabilization of borosilicates may be linked with a change in boron coordination from 3 to 4 in the sense described by B. E. Warren and co-workers. In this connection, it is noteworthy that in both C9 and C40 glasses, the ratio O/B+Si is very nearly 2, which favors the extensive four cordination of boron. There is also some possible effect from sodium ions migrating to positions where they are surrounded by oxygen atoms belonging to BO_4 tetrahedra, or even from the beginning of definite two-phase separation, such as occurs in the manufacture of Vycor glass. Further research on the dependence of viscosity-time effects on chemical composition would be very valuable; for example, in pure boric oxide glass and in the systems B_2O_3-SiO_2, B_2O_3-SiO_2-$(Na, K, Li)_2O$.

During the progress of this work, the question arose as to whether or not the annealing temperature of glasses determined by an optical method could correspond to a definite value of viscosity. Accordingly, the annealing temperatures of several glasses were determined optically by observing the temperature at which a rod becomes strain-free when heated at a uniform rate of 2° C. per minute. The results obtained showed that all the glasses, including the borosilicates, had a viscosity of about 10^{13} poises after 30 minutes heat treatment at their annealing temperatures.

Dielectric Properties of Glasses at Ultra-High Frequencies and Their Relation to Composition

The dielectric losses of glasses in the microwave range are extremely important in the design and development of equipment used to generate these frequencies. Navias and Green have, therefore, studied the dielectric properties of glasses at ultra-high frequency and the report of their investigation appears in the October 1946 issue of the *Journal of the American Ceramic Society*.

In this investigation, the dielectric constants and dielectric losses of 10.4 glasses of a wide range of compositions were measured at 10-cm. and 3-cm. wave lengths by the resonating cavity method (3000 and 10,000 megacycles, respectively). By correlating the power factor data with the compositions of these glasses, Navias and Green propose a qualitative explanation of the mechanisms producing energy absorption and dielectric losses in the microwave range. These mechanisms are determined by the nature of the bonds joining atoms and ions in the randomly oriented atomic networks of glasses.

The following conclusions were drawn from this investigation: 1) The continuous glassy networks of SiO_2 and B_2O_3 do not absorb appreciable energy in the microwave range of 10-cm. and 3-cm. wave lengths. Because the rigid atomic structures do not oscillate readily, the dielectric losses are low. Phosphorus pentoxide is indicated as behaving otherwise; 2) Those oxides which cannot be substituted for silicon or boron in the Si-O or B-O configurations are network modifiers. They weaken the atomic structures and the interstitial ions thus introduced oscillate and absorb energy; 3) Alkali ions being weakly held in the interstices of the network produce high losses. The greater the number of alkali ions present, the higher the energy absorption. The use of multiple alkalies in a glass tends to reduce the losses; 4) To a much lesser degree than the alkalies, the divalent ions of alkaline earths and lead contribute to energy absorption. Glasses containing high percentages of these ions show high dielectric losses. Compositions containing combinations of these ions show slight improvement in power factor, especially those with barium and lead; 5) Dissimilar interstitial ions, such as Na^+ and Ba^{++}, mutually interact with the result that energy absorption is reduced in certain cases. Thus, glasses with high contents of BaO or PbO, which consequently have high losses, show lower power losses when alkali ions are introduced. The losses of glasses containing alkali are lowered when RO is introduced; 6) The following general principle seems to apply: By increasing the number of elements in the R_2O and RO group present—that is, by increasing the complexity of the glass—the dielectric losses at ultra-high frequencies are slightly lowered; 7) Alumina appears to act as a network modifier in

(*Continued on page* 618)

CUT-GLASS PUNCHBOWL ON DISPLAY AT TOLEDO MUSEUM

Presentation of the Libbey Glass Company's famous cut-glass punchbowl to the Toledo Museum of Art was made recently by William E. Levis, Chairman of the Board

Famous Libbey punch bowl and its matching goblets presented to the Toledo Museum of Art. Reminiscing over the medal won by the bowl at the St. Louis Exposition in 1904 are (left to right) John H. Wright, Vice President of Owens-Illinois Glass Company and General Manager of its Libbey Division, and John (Rufe) Denman, the craftsman who cut the bowl.

of Owens-Illinois Glass Company of which Libbey is a division.

The four-gallon bowl, 25 inches in diameter and 24 inches tall, is the largest ever produced. The punchbowl was made specially for the St. Louis Exposition in 1904 where it won highest award and it has been part of Libbey's private collection since. It is evaluated today at $25,000.

In accepting the gift, William A. Cosline, President of the Museum Board of Trustees, described the bowl as "probably the finest piece of cut glass ever produced."

Honor guest at the ceremony was John (Rufe) Denman, a veteran of 58 years' service with Libbey, who spent almost two months in cutting the bowl 42 years ago. The late Con Nolan blew the bowl from a 12-inch gob of molten glass weighing 143 pounds.

STUDENT BRANCH OF A.C.S. HOLDS MEETINGS

The Virginia Polytechnic Institute Student Branch of the American Ceramic Society recently held its first autumn meeting at which the following officers were elected and installed: R. W. Crowell, President; A. A. DiNubila, Vice President; Ella MaeDesmond, Recording Secretary-Treasurer; and W. E. Hall, Corresponding Secretary.

At the next meeting which was held, W. C. Cooke, a graduate student in Ceramic Engineering, presented a talk on the manufacture of tempered glass. He described the general plant layout, each step in the manufacture of the glass and the methods used to test it.

• Fischer & Porter Company, manufacturers of variable area type flow rate instruments heretofore called "Rotameters," has recently announced its intention to change the name of its products to "Flowrators."

DR. MC CAULEY BROADCASTS ON GLASS

"Today's Glass" was the subject of Dr. George V. McCauley, Corning Glass Works research physicist, who was guest speaker recently on "Philharmonic Hour," over the Columbia Broadcasting System. The program, sponsored by the U. S. Rubber Company, regularly features a talk during intermission by leading figures in different fields of science.

Dr. McCauley divided his subject into three sections: Chemical composition of glass; forms into which it is fabricated; and the results of heat-treatment in the developing of new commercial glass properties.

"Glass today is whatever the glass research chemist and his co-workers in physics and engineering will it to be," said Dr. McCauley in pointing out the many different tasks that the modern researcher has been able to make glass perform. He discussed in detail the transmission properties of glass as determined by its chemical composition, describing infra-red and ultra-violet glass, which transmit invisible light, as well as glass that controls the direction of X-rays.

In his discussion of the various forms of today's glass, Dr. McCauley described methods of making such widely different products as Foamglas and glass textiles, giving a brief account of the many uses to which these new forms can be put.

As an illustration of the effects of heat-treatment on glass, Dr. McCauley described a new form of glass comprised of "pure" silica. Through reheating, this material can be used to make chemical ware of extraordinary properties. It is clear and transparent and transmits heat rays and ultra-violet radiations as well as light. A graphic illustration of its resistance to temperature changes was provided when the speaker said it could be heated red hot and then plunged into ice water without harmful effect.

"Strange and fanciful as some of these new glasses may seem," declared Dr. McCauley in conclusion, "already in the laboratory they are being supplemented by stranger and more fanciful substances that will become the glass of tomorrow."

DIAMOND NAMES ASSISTANT SECRETARY

The appointment of Donald S. Carmichael as Assistant Secretary has recently been made known by the Diamond Alkali Company.

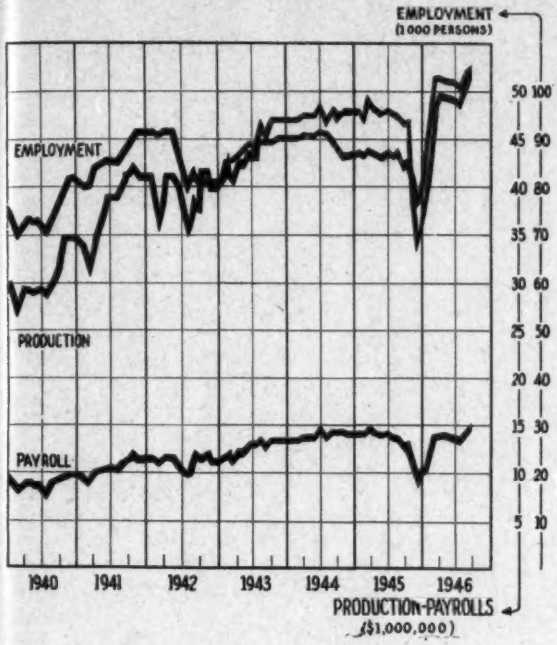
A graduate of Harvard College and the University of Michigan Law School, Mr. Carmichael is presently a member of the Cleveland law firm of Binyon and Carmichael. During the administration of Mayor Harold H. Murton, he served in the Department of Law of the City of Cleveland. During the recent war, Mr. Carmichael served as Chief of the Renegotiation Branch of Cleveland Ordnance District.

Mr. Carmichael will have offices at 2400 Oliver Building, Pittsburgh, Pa.

• John T. and Luzane Wynns Tayloe and Russel E. Brown have incorporated the Tayloe Glass Company with $30,000 capital stock to operate a glass business in retailing and manufacturing. The Company will be located at 2944 Locust Street, St. Louis, Missouri.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX



September 1946 figures showed an approximate 5 per cent jump over August, according to the Production Index. Production for September was an estimated $54,000,000, as compared with $51,500,000 reported for August. During September 1945, production reached an estimated total of $43,600,000, which is about 23 per cent under September this year. The estimated production for the first nine months of 1946 is $437,500,000, as compared with $420,900,000 during the same period in 1945.

Employment and payrolls: Employment during September 1946 rose slightly to a little over 104,000 persons. The August figure was slightly under 104,000. Employment during the September 1945 was 84,500 persons.

Payrolls also rose for the month of September. The figure for the month was an estimated $15,000,000, which is about 5 per cent over the $14,000,000 reported for August. Payrolls during September 1945 were $11,850,000. Glass manufacturers have paid out about $113,000,000 during the first three quarters of 1946. During the corresponding period in 1945, $119,850,000 was paid out.

Glass container production, based on figures released by the Bureau of Census, rose again for the month of October but did not quite top the all-time high production figure reported for August. The figure for October is 10,532,857 gross. This is about 7 per cent over the September figure which was 9,814,496 gross. Production during October 1945 was 9,847,011 gross. Total glass container production thus far in 1946 is 96,795,568 gross, as compared with 87,861,455 gross at the close of the same period in 1945.

Shipments of glass containers also rose for October and reached a total of 10,516,340 gross. This is about 7 per cent over the 9,777,660 gross shipped during September. During October 1945, shipments were 10,077,794 gross. Shipments made during the first ten months of 1946 were 96,765,649 gross, in comparison with the 89,677,978 gross shipped during this period in 1945.

Stocks on hand at the close of October were 3,905,661 gross as compared with stocks of 3,942,188 at the close of September and 3,786,132 gross at the close of October 1945.

Plate glass production reached an all-time high for the month of October breaking the previous high which

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production October 1946	*Stocks October 1946*
Foods*; Medicinal & Health Supplies; Chemicals, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	3,427,401	1,803,917
	Wide Mouth	3,955,799	1,134,303
Dairy Products		368,915	152,464
Beverages, Returnable		616,868	349,672
Beverages, Non-Returnable		.....	.....
Beer, Returnable		506,429	48,866
Beer, Non-returnable		60,998	14,535
Liquors		1,009,231	174,131
Wines		435,294	70,099
Total		10,532,857	3,905,661

GLASS CONTAINER SHIPMENTS

(All figures in gross)

	October 1946
Narrow Neck Containers	
Foods	971,113
Medicinal & Health Supplies	1,320,763
Chemical, Household, Industrials	578,961
Beverages, Returnable	570,509
Beverages, Non-returnable	.....
Beer, Returnable	512,501
Beer, Non-returnable	63,812
Liquors	980,550
Wines	427,108
Toiletries & Cosmetics	648,865
Sub-Total (Narrow)	6,074,182
Wide Mouth Containers	
Foods*	3,204,365
Dairy Products	363,605
Medicinal & Health Supplies	349,446
Chemical, Household, Industrials	107,932
Toiletries & Cosmetics	171,529
Sub-Total (Wide)	4,301,821
Total Domestic	10,376,003
Export Shipments	140,337
Total Shipments	10,516,340

*This figure includes Home Canning and Packers' Tumblers.

Attention . . .

Glass Tank Operators

For Maximum Life SPECIFY

C · S · R

CAST SUPER REFRACTORY

For

Mantels, Feeder Parts, Tuckstones, Burner Blocks, Port Covers, Port Bottoms, Port Arches, Port Skews, Port Baffles, Lintels, Jambs, Bridge-wall Covers, etc.

C.S.R. ***has excellent resistance to***

HIGH TEMPERATURES
CORROSION
SHRINKAGE
SPALLING

C.S.R. ***is***

VACUUM CAST
ACCURATE TO SIZE
UNIFORM TEXTURE
ECONOMICAL

•

Write for Full Particulars

WALSH REFRACTORIES CORP.

High Grade Refractories for Over 50 Years

4070 NORTH FIRST STREET ST. LOUIS 7, MISSOURI

was established in April 1937. According to the Hughes Statistical Bureau, production for October was 23,270,656 sq. ft. This figure represents an approximate gain of 10 per cent over the September figure which was 21,142,287 sq. ft. Plate glass production during October 1945 was 7,334,978 sq. ft. Total production during the first ten months of 1946 was 170,814,531 sq. ft. as compared with 83,616,121 sq. ft. produced during the same period in 1945.

Automatic tumbler production for the month of October 1946 rose about 15 per cent to 7,762,838 dozens. During September, 6,710,674 dozens were produced and during October 1945, the figure reported was 6,652,585 dozens. Shipments also showed an increase and rose about 26 per cent from 6,077,694 dozens shipped in September to 7,657,228 dozens for October. During October 1945, shipments were 6,457,813 dozens. Stocks on hand at the close of October 1946 were 5,326,415 dozens as compared with 5,352,309 dozens at the close of September and 4,876,333 dozens at the close of October 1945.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware for October 1946 rose to 4,999,568 dozens. This is about 37 per cent over the 3,645,278 dozens sold during September. Sales during October 1945 were 3,103,270 dozens. Manufacturers' sales at the close of the 12-month period ending October 1946 were 47,400,772 dozens.

RESEARCH DIGEST . . .
(*Continued from page* 615)

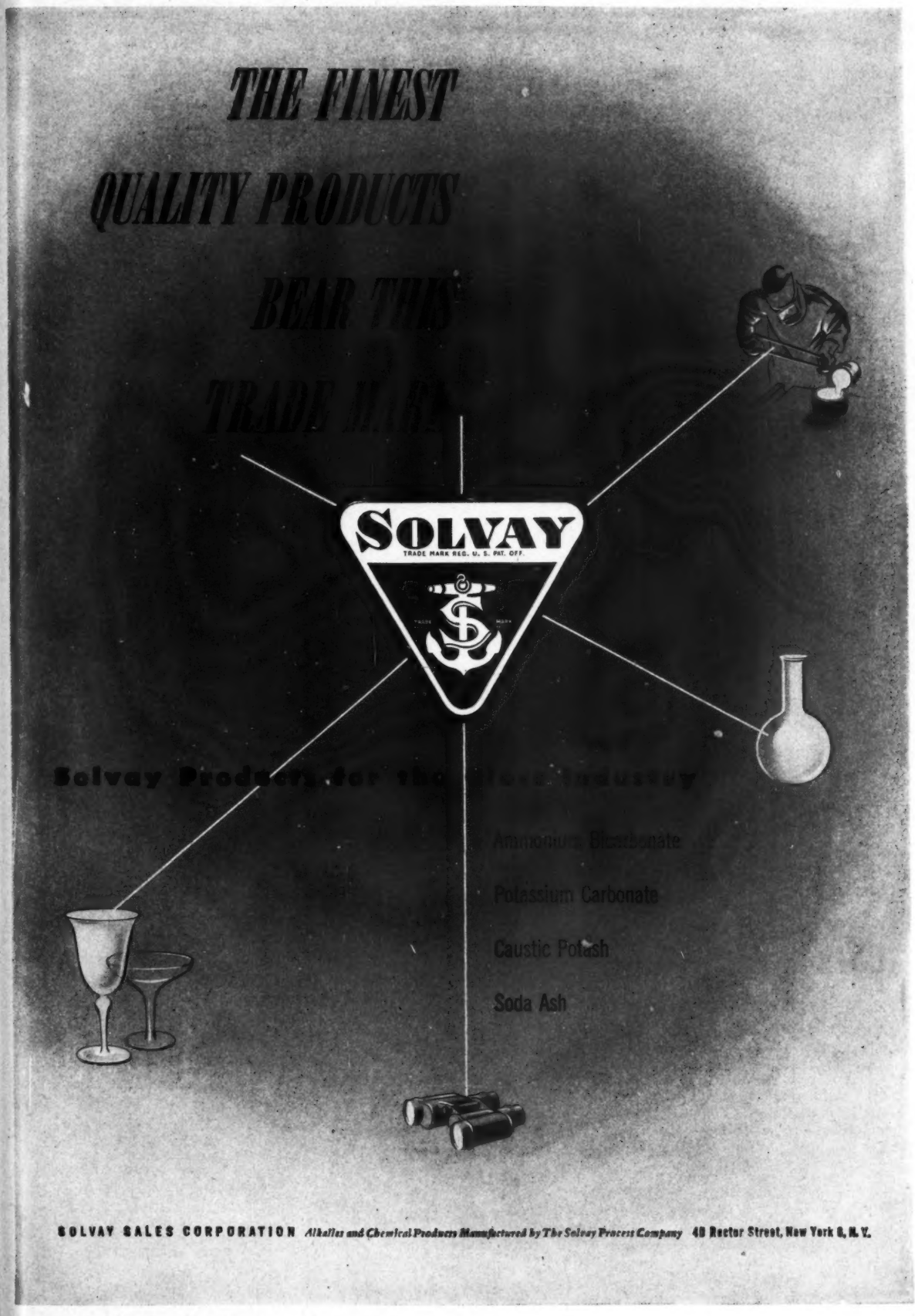
glasses and its presence results in increasing dielectric losses.

It was indicated that it should be possible to express the dielectric constant of glasses in terms of additivity factors for the individual constituents in a manner similar to that by which thermal expansion, density and other physical properties can be calculated.

FIBERGLAS MAT FOR PLASTICS REINFORCEMENT

A new type Fiberglas mat designed as a base, or reinforcement, for low-pressure laminating resins has been announced by Owens-Corning Fiberglas Corporation. Known as Fiberglas Mat Code T-35, the new mat is particularly suitable for use in laminates that must possess high impact resistance and wet strength. The resulting laminates have "balanced" strength; that is, equal strength in all directions.

The mat is composed of continuous strands of low-twist textile-type Fiberglas yarns laid down in the circular pattern and bonded with a special resin which is compatible with polyester low-pressure resins. The dip method can be employed to impregnate the mat, or it can be laid up dry and impregnated by spraying, dripping or injecting resin. The binder softens when the mat is warmed to 115° F., permitting preforming to a desired shape before impregnating. Warming will also permit drawing the mat after impregnation.


THE FINEST
QUALITY PRODUCTS
BEAR THIS
TRADE MARK
SOLVAY
TRADE MARK REG. U. S. PAT. OFF.
Solvay Products for the Glass Industry
Ammonium Bicarbonate
Potassium Carbonate
Caustic Potash
Soda Ash
SOLVAY SALES CORPORATION Alkalies and Chemical Products Manufactured by The Solvay Process Company 40 Rector Street, New York 6, N. Y.

R. A. COSH TO MANAGE O-I EASTERN PLANTS

The promotion of Richard A. Cosh to the position of Eastern Factories Manager has recently been announced by the Owens-Illinois Glass Company. Mr. Cosh has been the company's Chief Engineer since 1935 and is now being transferred from the Alton plant to the general office in Toledo.

The promotion of Mr. Cosh created a vacancy at Alton which resulted in three additional promotions. James E. McBurney has been transferred from Huntington to the position of Chief Engineer in Alton to replace Mr. Cosh. Courtney Budd takes Mr. McBurney's place as Manager of the Huntington plant and Joe Hamilton was appointed to the position of Plant Manager at Columbus.

Mr. Cosh joined Owens-Illinois at Alton in 1920 as a draftsman after completing his engineering education at the University of Minnesota. He progressed through the positions of Shop Foreman and Shop Manager at Alton and served four years as Plant Manager at Gas City, returning to Alton in 1935 as Chief Engineer.

Additional promotions announced by Owens-Illinois are those of Fay E. Martin, Harold Maranda, John Northup and W. Boyd Owen.

Mr. Martin, who has been Plant Manager at Streator since 1933, with the exception of 1935 and 1936 which he spent managing the Fairmont plant, will go to Alton as General Manager of the enlarged Mold and Machine Shops. Mr. Maranda, Plant Manager at Charleston since 1939, will become Plant Manager at Streator; Mr. Northup, Plant Manager at Clarion since 1943, will become Plant Manager at Charleston; and Mr. Owen, who has been Personnel Director at Fairmont for eight years, will become Plant Manager at Clarion.

ARTHUR D. LITTLE, INC. MARKS SIXTIETH ANNIVERSARY

Arthur D. Little, Inc., has recently announced its sixtieth anniversary making it probably the oldest of the existing consulting industrial research laboratories.

The laboratories were founded as the firm of Griffin and Little in a small office in downtown Boston in 1886. The present staff of 175 now occupies a group of buildings in Cambridge, Mass., and, with the general growth of interest in industrial research, has been extended to cover practically all fields of applied science, including applied biology, chemistry, chemical engineering, mechanical development and technical economic evaluation of new ventures.

• The formation of an additional sales unit of the Technical Products Division has recently been announced by Corning Glass Works. Named the Coffee Maker Sales Department, it will be managed by Cleland Barker, formerly of the Division's Industrial Sales Department.

SYLVANIA APPOINTS QUALITY CONTROL DIRECTOR

The appointment of Jerome R. Steen as Director of Quality Control for the Lamp, Fixture, Wire Products, Tungsten and Chemicals, Radio Tube and Electronic Division of Sylvania Electric Products, Inc., has recently been announced. Mr. Steen will be responsible for functional supervision of all quality control personnel within the company.

Mr. Steen joined the staff of Sylvania Electric in 1931 as supervisor in charge of finished tube quality control at the Emporium, Pa., plant. In 1936, his work expanded to include similar activities at the Salem, Mass., plant. He was transferred to the commercial engineering department in 1942 and appointed manager of the quality control engineering department, Radio Tube Division, late in 1944.

Prior to joining the Sylvania staff, Mr. Steen was associated with General Electric Company, Grigsby-Grunow Company and the Bell Telephone Laboratories.

NEW YORK METROPOLITAN SECTION TO MEET

The New York Metropolitan Section of the American Ceramic Society will hold its next meeting on Wednesday, December 4, at the Building Trades and Employers Association Building in New York City.

Guest speaker for the evening will be W. L. Stafford of Johns-Manville Research Laboratories. For his subject, Mr. Stafford has chosen "Refractory Insulating Brick".

It has also been announced that the following meeting has been tentatively scheduled for February 19 and it is expected that the annual meeting of the Section will be held in May.

CONTROL OF CANTON GLASS COMPANY CHANGES

At the annual meeting of the Directors of the Canton Glass Company, Inc., new officers were elected and it was revealed that control has passed from the family of the late B. M. Nussbaum, former President and son of the founder.

Under the reorganization, Earle A. Kightlinger became President and General Manager; William M. Wright was named Vice President and Treasurer; J. D. Wright, Secretary; and Luther C. Taylor, Assistant Secretary.

• Lawrence L. Jones has been named Superintendent of General Electric Company's new factory for the manufacture of Glyptal alkyd resins. The new factory is expected to start production before the end of the year. It will comprise 35,000 square feet consisting of a process building, storage building, two pump houses and a boiler house.

ONE TANK'S PERFORMANCE OVER EIGHTEEN YEARS

THE statistics below give the performance figures of *one* glass furnace, melting flint glass, for twelve consecutive fires, over a period of eighteen years.

It is a record of progress made possible by steady advances in furnace design and operation, and in the use of better refractories.

Please note that since 1928, the total days of life have been increased 356% and that the total tonnage of glass delivered has been increased 951%.

The Corhart Refractories Company is proud to have helped in proving that *a modern glass furnace can turn out tonnages that were impossible in older furnaces—and do it with very large savings in repair costs per unit of glass products.*

Corhart Refractories Co., *Incorporated,* 16th and Lee Sts., Louisville 10, Ky. . . *In Europe:* L'Electro Refractaire, Paris.

PERFORMANCE DATA FOR ONE TANK OVER A PERIOD OF EIGHTEEN YEARS

DATE →	JAN. '28 JULY '28	SEPT. '28 MAY '29	JUNE '29 APRIL '30	JUNE '30 SEPT. '31	NOV. '31 DEC. '32	FEB. '33 MAR. '34	MAY '34 DEC. '35	JAN. '36 JUNE '37	JULY '37 NOV. '38	FEB. '39 MAR. '41	APRIL '41 JULY '43	SEPT. '43 MAY '46
MATERIAL IN FURNACE	All Clay Tank—15" Sidewalls	All Clay Tank—15" Sidewalls	Corhart Bridgewall—15" Clay M.E. Sidewalls	Corhart Bridgewall 12" thick Corhart Top Course and 15" thick Clay Lower Course M.E.	All Corhart Tank—12" M.E. Sidewalls	All Corhart Tank—12" M.E. Wall and 120 sq. ft. M.E. Bottom	All Corhart Tank—12" M.E. Wall and ; Corhart M.E. Bottom	All Corhart Tank—12" M.E. Wall and ; Corhart M.E. Bottom	All Corhart Tank—12" M.E. Wall and ; Corhart M.E. Bottom	All Corhart Tank—12" M.E. & R.E. Wall and all Corhart M.E. Bottom	All Corhart Tank—12" M.E. & R.E. Wall and all Corhart M.E. Bottom	All Corhart Tank—12" M.E. & R.E. Wall and all Corhart M.E. Bottom
MELTING AREA (SQ. FT.)	834	834	834	834	834	834	834	854	854	834	834	834
TOTAL DAYS LIFE	212	246	300	402	405	413	600	500	514	738	813	967
TOTAL OPERATING DAYS	175	201	249	365	330	335	500	437	418	634	738	748
TONS GLASS DELIVERED	6648	8620	10356	16400	17561	19873	39134	47753	40861	52037	77465	69897
TONS GLASS PER OPERATING DAY	37.99	42.89	41.59	44.93	53.22	59.32	78.27	109.47	97.75	82.08	104.99	93.44
SQ. FT. MELTING AREA PER TON GLASS PER DAY	21.9	19.4	20.3	21.8	17.8	16.5	10.7	7.8	8.7	8.2	7.9	8.9
TOTAL TONS COAL USED	4292	4810	6215	10540	10680	10208	19154	17176	17757	27179	32338	38322
TOTAL TONS COAL USED ON OPERATING DAYS	3732	4187	5445	8630	9232	8892	17024	16002	15684	24544	30512	32223
BTU PER TON GLASS DELIVERED	103348×10^2	89425×10^2	96802×10^2	96880×10^2	96785×10^2	82371×10^2	80089×10^2	61691×10^2	70665×10^2	86833×10^2	72495×10^2	64870×10^2
COAL EQUIVALENT AT 13150 BTU PER LB. (70% PRODUCER EFFICIENCY) (LBS. COAL PER LB. GLASS)	.561	.486	.526	.526	.526	.417	.435	.335	.384	.472	.394	.461
NATURAL GAS EQUIVALENT AT 1000 BTU PER CU. FT. (PER TON GLASS)	10335	8943	9680	9688	9679	8237	8009	6169	7066	8683	7249	8487
FUEL OIL EQUIVALENT AT 140,000 BTU PER GALLON (PER TON GLASS)	68.9	59.6	64.5	64.5	64.5	54.9	53.4	41.1	47.1	57.9	48.33	56.58

NOTE: This tank had a 40" metal line in all campaigns. The ware manufactured was flint containers.

NEW EQUIPMENT AND SUPPLIES

HARTFORD-EMPIRE SEEDSCOPE

The Hartford-Empire Company, 411 Homestead Avenue, Hartford 1, Conn., has introduced a new equipment item called the Seedscope. The Seedscope is used to measure quantitatively the concentration of seeds in glass. The average seed count for container ware is twenty seeds per ounce.

It is sturdily constructed of sheet steel to stand up under continuous factory use. The facepiece is flanged and cut to fit the face in order to eliminate extraneous light from entering the optical system. The optical system consists of a source of parallel light, a magnifying lens to facilitate counting and a front surface reflecting mirror. The plastic bottom which supports the sample dish is marked with parallel lines to serve as guides in counting the seeds.

This method for determining the concentration of seeds in glass is to select a representative sample, counting the number of relatively large bubbles and the total number of bubbles. These concentrations are then calculated respectively, as the number of blisters per ounce and the number of seeds per ounce. The number of seeds per ounce is reported to the nearest multiple of five. If the number is less than five, the number actually counted is reported.

The first step is the selection of the sample: *Cylindrical ware*—Cut a ring section 1½" wide from the wall of the bottle. From this section cut at equal intervals four pieces totalling approximately 1 ounce weight; *Rectangular ware* (*Panel type*)—Cut a piece 1½" x 1¼" from each of the four sides; *Unusual shapes or very small ware*—Select sample pieces representative of the circumference of the ware and having a total weight of about 1 ounce. After this has been done, determine the total weight of the four pieces to the nearest 1/16 oz. Inspect the pieces by holding them before an adequate light source. Count the relatively large bubbles observed and record as total blisters.

The next step is to turn on the switch to light the Seedscope and turn back the hood which is fastened to the base with a double hinge. Fill the immersion dish with enough monochlorbenzene to cover the sample and by means of the forceps place one of the cut sections in the fluid with the convex side up and a curved edge toward the light source. Center the piece in the dish so that it will be uniformly illuminated by the parallel light. Replace the hood and count the bubbles which appear as bright dots, use the guide lines for reference and record the number of bubbles on the mechanical counter. Repeat the procedure with each of the remaining pieces of the sample and record the total number plus blisters counted.

The seeds per ounce and blisters per ounce are computed by the following formulae:

$$\text{Seeds per ounce:} \quad \frac{\text{Total Number of Bubbles}}{\text{Wt. of sample in oz.}}$$

$$\text{Blisters per ounce:} \quad \frac{\text{Total number of relatively large bubbles}}{\text{Wt. of sample in oz.}}$$

NEW TYPE DECALCOMANIA TRANSFER

The American Decalcomania Company, 4334 West Fifth Avenue, Chicago 24, Illinois, has announced a new type decalcomania that provides for the decorating of glass mirrors.

The new product is applied to the glass before it is mirrored and will not discolor upon contact with the silvering solution, it is stated. Formerly, open decalcomania designs required a film of clear lacquer to keep the design intact in transferring. This clear lacquer film was objectionable in the mirroring operation since it would not permit the silvering solution to come in contact with the glass. The lacquer film is eliminated in this new development.

LIQUID LEVEL INDICATOR IMPROVED

The Reliance Gauge Column Company, Cleveland, Ohio, has announced a newly styled, newly engineered model of the Eye-Hye remote reading liquid level indicator which they have been marketing for ten years.

Besides giving the new device a new face plate, the construction has been altered to achieve greater compactness and certain structural advantages. Use of a plastic diffusing screen improves the distribution of the interior illumination. The case has been made drip-proof and the arrangement of the interior more accessible for cleaning and renewing of illuminating lamp.

The new Eye-Hye, Model E-32, is the first of several which will replace the original series.

CATALOGUES RECEIVED

Solvay Sales Corporation, 40 Rector Street, New York 6, New York, has announced the publication of a new edition of Solvay Technical & Engineering Service Bulletin No. 5, "Soda Ash."

The new 64-page bulletin contains chapters on the properties of Soda Ash, bulk shipments, storage, conveying and elevating, unloading of bulk, unloading of bags and barrels, sampling and analysis, precautions and conversion tables.

B. F. Goodrich Company, Rose Building, Cleveland 14, Ohio, has released a 12-page illustrated technical bulletin entitled "Kirston Thermosetting Resin" covering properties and processing information for the company's new thermosetting allyl ester casting resin.

Manufactured in a natural, uncolored monomer form, Kirston is a pure crystalline solid at ordinary room temperature and melts at 110° to a clear syrup liquid. Ferrous and nonferrous materials such as aluminum, glass and plaster of Paris may be used as molds for Kriston which can be cast in transparent, transient or opaque colors.

The Rapids-Standard Company, Inc., Grand Rapids, Michigan, has issued a newly revised six-page folder entitled "Your Man Friday" describing the Stevedore, Jr. power belt conveyor.

The folder includes descriptions and photographs of all the latest developments on this belt conveyor, including the exclusive cable-lift elevation device which facilitates adjusting the operating pitch of the belt while stacking materials at various levels.

Typical installation photographs of the Stevedore, Jr. in use are presented in the folder, and an inner two-page spread describes construction details and other features of the conveyor. Detailed specifications are also listed. Close-up photographs show the Stevedore, Jr., self-supporting adjustable head and tail sections and the patented Rapid-Lock support with horseshoe dolly base. Also illustrated is other Rapids-Standard equipment.

The Brown Instrument Company, Division of Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has recently issued a new catalogue featuring its Rectangular Case Thermometers and Pressure Gauges.

Vapor, gas and mercury actuated thermometers and pressure gauges are illustrated and described and there is a large cut-away illustration showing the design improvements found in Brown thermometers and pressure gauges with each part clearly labelled for easy identification. Bulbs, charts and interchangeable cases are fully treated as are the operating features of the instruments.

LEFT HIGH AND DRY BY COLOR PROBLEMS?

● Every production chief knows from experience that the unexpected can founder color application schedules and waste a lot of money.

But the economy-minded chief who flashes an SOS to Drakenfeld quickly learns that practical help, backed by more than three generations of experience, can go a long way toward cutting the high costs created by color problems. So if you are interested in minimizing rejects, increasing production, and saving time and effort, call on Drakenfeld for dependable colors, coloring chemicals, and supplies. And if it is a color-matching job that is bothering you, our technologists will gladly cooperate in developing a formula that fits your ware and your methods of production. So get in touch with Drakenfeld. Do it today.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Crystal Ices . . . Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Decorating Supplies.

Drakenfeld

YOUR PARTNER IN SOLVING COLOR PROBLEMS

B. F. DRAKENFELD & Co., Inc. 45-47 Park Place, New York 7, N.Y.

Factory and Laboratories: Washington, Pa.

Pacific Coast Agents: Brayer Corp., Los Angeles 21 . . . Brayer-Knuebel-Heimann Co., San Francisco 19

LOW FREQUENCY SPECTRA . . .
(*Continued from page* 609)

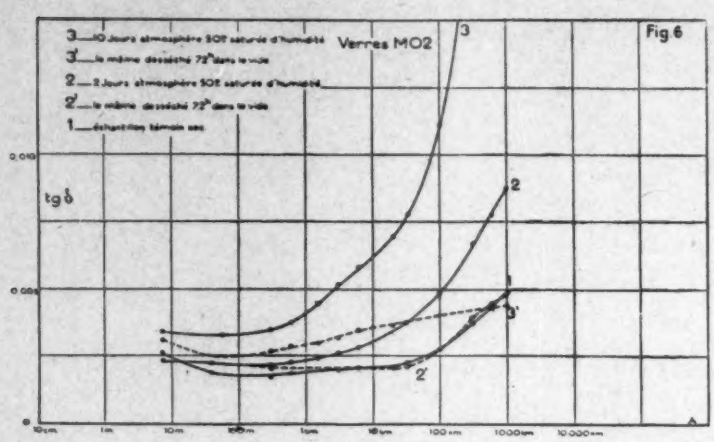


Fig. 4

another character. Each glass is represented in three degrees of annealing: quenched (—), intermediate (— — —), annealed (— • • — • • —), quenched glasses show higher values of tan δ, i.e. higher polarizability.

For glasses exposed to humidity, tan δ values increased considerably at high frequency. This corresponds, formally, to higher dipole moments. (Fig. 4) (6 in the original). (1—dry, 2—two days sat. humid., 3—10 days sat. humidity, each at 50°C.).

The alteration of the surface was not fully reversible if the exposure was long (2′, 3′—samples exposed as 2, 3, then dried).

The general picture is not surprising, but the method is novel and promises to permit a fine analysis of glasses of extreme and known compositions as well as of surface changes on glasses of identical bulk composition. N.J.K.

INVENTIONS AND INVENTORS . . .
(*Continued from page* 614)

26, belts 27 and 30 and pulleys 31, 32 and 33 fixed on the spindles.

Shafts 35 and 36 extend between the frames 8 and a pair of plates 37 are mounted to slide to position on the shafts according to the length of the tube to be cut. Each of these plates carries a set of the cutting implements which are both electrical and mechanical. Each plate 37 is comprised of two pairs of electrodes 40 and 41, and 42 and 43, each pair of electrodes being connected by a heating wire passing below the tubes to be severed. Current is supplied from a transformer 48 through flexible connections 49 and 50. The heating wires are arranged so as to be slightly out of contact with the glass.

After the glass is heated, carborundum knives 51 carried on arms 54 are moved down into contact with the glass by a foot treadle 57 which acts against counterweights 58. The contact of the knives 51 with the heated portion of the tube produces a clean cut of the tube.

Patent No. 2,411,031 is on a method of making optical glass and it was assigned to E. I. du Pont de Nemours & Company by the inventor, Alden J. Deyrup of Westfield, New Jersey.

Optical glass is usually made by cooling it in the container where it was melted and then breaking it into lumps. Great difficulty is encountered in getting such glass sufficiently free from seeds and striae. The glass is often contaminated by the pot material and while this can be avoided by the use of platinum pots, this is very expensive and not wholly successful with some compositions.

This invention proposes to produce high grade optical glass by flowing molten glass into a homogenizer where the mass is split into a number of streams and then recombined in a different order than that in which it was divided.

Fig. 10 is a diagram showing how this method may be carried into effect. A stream of glass D which may come from a continuous melting tank flows into a "dish" F held in a shell E.

Suitable means is provided for heating the shell but this is not shown in the figure. The dish F has perforations in the bottom and rods or wires G lead the streams of glass into a second dish F_2 in a different relative arrangement than they had in the upper dish F_1.

In a similar way, five streams flow from the dish F_2 to the dish F_3 and then to the dish F_4. The final stream

(*Continued on page* 630)

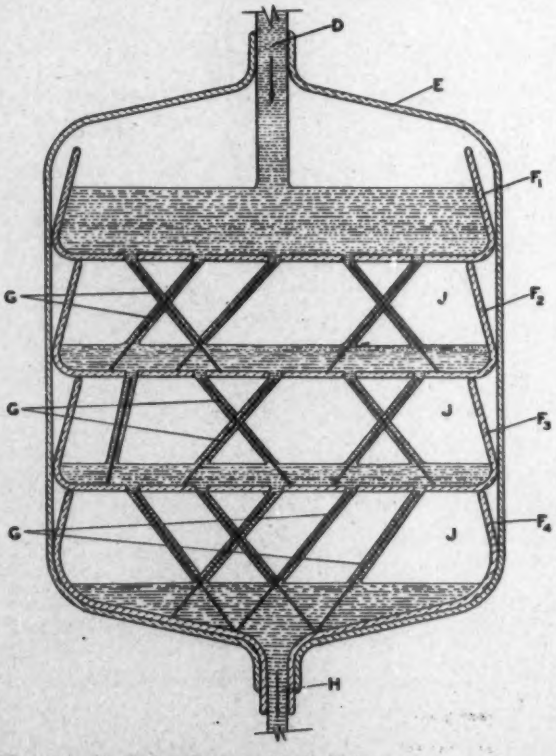


Fig. 10. Method of Making Optical Glass

More New Fluorine Compounds by General Chemical

POTASSIUM
KF • HF
BIFLUORIDE

POTASSIUM
KF • 3HF
POLYACID
FLUORIDE

SOME POTENTIAL USES:

HEAT TREATING—Means of controlling the melting point of heat-treating salts.

GLASS—In etching glass or other silicon-bearing products. As "frosting" agents.

CERAMICS—As opacifiers. As materials to increase the fluidity and alter the melting point of the mix.

CHEMICAL PROCESSING Source of HF in dry form. For preparation of elemental fluorine by electrolysis.

ELECTRONICS—Special medium for etching quartz crystals.

MINING—Agents for digestion of insoluble ores.

METALLURGY—As ingredients in fluxes and pastes for welding, brazing or soldering. For surface preparation of aluminum and stainless steel before spot welding.

General Chemical Fluorine Research announces Potassium Bifluoride and Potassium Polyacid Fluoride to American Industry. These are versatile, reactive products whose properties indicate varied applications. For example, consider their potentialities in the fields suggested here.

Perhaps such uses point to a place for either Potassium Bifluoride or Potassium Polyacid Fluoride in *your* development or production program. Experimental samples are available from General Chemical Company, Fluorine Division, 40 Rector Street, New York 6, N. Y., or through the nearest Sales and Technical Service Office.

When writing for the information you need, why not outline your proposed uses for these products? This way the technical experts of our Fluorine Division can work with you toward an early solution of your problem.

BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

GENERAL CHEMICAL COMPANY
40 RECTOR STREET • NEW YORK 6, N. Y.

Sales and Technical Service Offices: Atlanta • Baltimore • Birmingham Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland Denver • Detroit • Houston • Kansas City • Los Angeles • Minneapolis New York • Philadelphia • Pittsburgh • Providence • San Francisco Seattle • St. Louis • Utica • Wenatchee (Wash.) • Yakima (Wash.)
In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited Montreal • Toronto • Vancouver

REPLACEMENT OF BORIC OXIDE AND LEAD OXIDE . . .

(*Continued from page* 606)

free of B_2O_3, meeting practically all requirements. The only disadvantage found in these glasses free of boric acid was the higher softening point which in turn required higher temperatures for working in the blow torch.

The general trend in Germany to replace metals wherever possible led to the use of glass for chimes and electric signal bells. First it seemed that only the heavy lead glasses were suitable for this purpose because of their good ring. Guided by previous research on the elastic properties of glasses as a function of the composition, the authors developed potash-barium glasses with good acoustic properties. It was found advisable to replace a part of the barium by zinc, because high barium glasses are difficult to fine. From the viewpoint of melting, fining, workability (pressing) and acoustic properties the following glass compositions proved to be most satisfactory:

	VIII	IX	X
	%	%	%
SiO_2	65.0	69.0	65.0
BaO	15.0	10.0	13.7
ZnO	...	3.0	3.0
Na_2O	8.0	6.0	7.3
K_2O	12.0	12.0	11.0

The most difficult problem was the development of a lead free glass for inner parts of electric light bulbs, discharge tubes and similar devices. Lead oxide containing glasses were generally used for those parts which had to be blown or pressed automatically from tubings or rods by high speed machines. These glasses especially when drawn by a Danner machine must have an extremely low rate of crystallization. The number of crystal nuclei formed in the range of 900°-600° C. should be very small and for some purposes the speed of crystal growth should not much exceed 0.1 μ per minute. Research extended over a period of several years led to the result that it was not possible to develop a lead free glass having all the good properties of the traditional lead glasses. As a compromise a glass of the following composition was used:

	XI
SiO_2	61.5%
Al_2O_3	0.5%
B_2O_3	1.0%
MgO	0.7%
CaO	1.3%
BaO	11.0%
ZnO	7.0%
Na_2O	7.0%
K_2O	8.0%
F_2	2.0%

This composition is carefully balanced and does not stand much variation. Increasing the SiO_2 content leads to crystallization of silica. Lowering the SiO_2 also causes devitrification, probably of various silicates. The alkali content had to be 15% in order to produce the desirable thermal expansion (90×10^{-7}/° C.).

The distribution of this 15 per cent between Na_2O and K_2O is again a compromise between the ratio $K_2O:Na_2O = 4:1$ which would produce the best electric insulation and the ratio 1:2 which would be desirable from the viewpoint of workability. Barium, zinc and fluorine are important constituents for regulating the viscosity. The ratio of barium to zinc was selected from the viewpoint of minimum devitrification. The boric oxide content was kept as low as possible, one per cent, and it was expected to lower it still further by introducing sodium titanium silicate. (Flux V26 of the I. G. Farbenindustrie).

The glass XI is satisfactory in chemical respects but does not meet the highest demands in electrical insulating properties. In connection with this glass where PbO and B_2O_3 are replaced by a combination of CaO, MgO, ZnO and BaO, the authors discuss similar efforts made in the ceramic industry, when PbO and B_2O_3 became unavailable for ceramic glazes. Fr. Alzner (*Ber. Deutsche Keram. Ges. 21* (1940) 17) and H. Lehmann (*Ber. Deutsche Keram. Ges. 21* (1940) 53) developed the following two glaze formulas, which also contain a combination of the four divalent oxides.

I.

0.20-0.30 KNaO 0.25-0.35 CAO 0.08-0.16 MgO 0.15-0.30 BaO 0.08-0.12 ZnO	0.15-0.25 Al_2O_3	1.50-2.30 SiO_2

II.

0.40 KNaO 0.20 BaO 0.08-0.16 MgO 0.08-0.16 CaO 0.08-0.16 ZnO	0.10-0.20 Al_2O_3	1.50-2.30 SiO_2

*A communication from the Osram Laboratory by H. Kalsing, M. Thomas, M. Wagner and J. Enss, *Glastechnische Berichte 18* (1940) 210-213.

GAMES SLAYTER PRESENTS PAPER ON FIBERGLAS-REINFORCED PLASTIC

Games Slayter, Vice President in Charge of Research and Development, Owens-Corning Fiberglas Corporation, presented a paper at the recent meeting of the American Society of Body Engineers entitled "Production and Fabrication Possibilities of Fiberglas-Reinforced Plastics."

In his talk, Dr. Slayter stated, "We know that Fiberglas-reinforced plastics provide a combination of properties highly desirable in an engineering material and we think the possession of these properties entitles it to serious consideration as a material for the construction of the bodies of all types of automotive vehicles."

Dr. Slayter went on to tell about the research efforts made by the Material Command, U. S. Army Air Forces at Wright Field and the progress made. He told about the use of the combined Fiberglas-plastic automobile body and chassis designed by William B. Stout and described the production steps for its construction. Dr. Slayter then went on to discuss the physical properties of Fiberglas-plastics and, in closing, presented a suggested layout of a production line for Fiberglas-plastic automobile bumpers.

Penn Salt's

HYDROFLUORIC ACID

etches and polishes

HEISEY GLASSWARE

ANHYDROUS HF

was first produced commercially in our Easton, Penna., plant. It is used as an alkylation catalyst in the production of high octane gasoline. It is also used in the production of organic fluorine compounds, in the synthesis of other organic compounds, and for the preparation of high purity inorganic fluorine compounds. Shipped in cylinders and tank cars.

For the etching and polishing of fine glassware, Penn Salt's Hydrofluoric Acid is used more today than ever before. It is also valuable in cleaning steel, for the frosting of light bulbs, and for many other industrial purposes.

Hydrofluoric Acid strengths below 60%, and special grades of 60% are shipped in rubber drums. Strengths from 60% to 80% in steel drums.

For complete information, write to Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pa.

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

New York • Chicago • St. Louis • Pittsburgh • Cincinnati • Minneapolis • Wyandotte • Tacoma

CAST-TO-SHAPE

GUIDE RINGS and NECK RINGS

Jessop Cast-to-Shape Guide Rings and Neck Rings for the glass industry are cast-to-shape from 3-C Special High-carbon-high chromium tool steel . . . the same steel which is used for high production dies in the metal working industry. 3-C Special can be air-hardened to Rockwell C 64 with a very minimum of distortion, and its extremely high wear resistance results in greatly increased production. A comparative test in your plant will convince you of the superiority of Guide Rings and Neck Rings cast from this alloy.

Jessop also makes molds and plungers cast from a special type stainless steel developed for the glass industry. Actual plant tests have proved that these molds and plungers increase production 10-20 times before replacement is necessary.

Write for further information on JESSOP'S stainless and alloy castings for the glass industry.

JESSOP STEEL CO.

MAIN OFFICE AND WORKS

WASHINGTON, PA.

SCALE GLASS . . .

(*Continued from page* 608)

		Mica	Scale glass
I	*Mechanical properties*		
	Cleavability	+	—, but any desired thickness > 30 μ can be made [1]
	Permits punching	+	+
	Flexibility	+	+
	Smoothness[2]	+	+
	Deformability[3]	—	+
II	*Electrical properties*		
	Electrical conductivity	the same for mica and hard glass	
*	Dielectric losses	1×10^{-4}	5×10^{-4}—40×10^{-4} [4]
	Dielectric constant	6	3—6 [4]
III	*Thermal properties*		
	Thermal durability	to 700°C	to 1000°C (for hard glass)
	Thermal conductivity	// cleavage plane 0.011 cal/degr cm sec ⊥ cleavage plane 0.001 cal/degr cm sec	// surface 0.002 cal/degr cm sec [5] ⊥ surface 0.0003 cal/degr cm sec [5]

Explanations of the table:

1) Plates up to 1 mm thickness were made, but this is certainly not the limit.

2) This is the property which means that a pin can be stuck through the material and held rather firmly but nevertheless remains removable (of importance in case of application in radio valves)

3) This is the property which indicates that wet plates may still be shaped to a desired form which becomes fixed after drying.

4) These properties are dependent on the glass used. Generally speaking, the dielectric losses of scale glass of a certain composition are the same as for the corresponding compact glass, whereas the dielectric constant is about half the value of that of the corresponding compact glass.

5) These data are measured for the lead glass mentioned in section 3.

8. Applications. Scale glass can be used with success in the following cases:

a. In radio valves. Here scale glass can be substituted for mica. The emission of the valve is not affected by the substitution of scale glass for mica. Advantages of the former are higher temperature resistance, lower thermal conductivity. The property of deformability gives the possibility of bent plates.

b. Transmission valves. Here the dielectric losses of the usual glasses are a drawback. Recently developed glasses, however, (with $\tan \delta = \pm 5 \times 10^{-4}$), which have up to now not been tried as scale glass, may offer a solution.

c. Other applications. For heating elements in flat irons, electric kettles and other domestic apparatus, scale glass is a suitable material, as was proved by experiments with constant load. The property of deformability is here a great advantage compared with mica. Of some importance also is the possibility of the production of plates with varying thickness, generally speaking, of three-dimensional constructions. Also the possibility of "baking in" wires etc., may be of importance for such constructions.

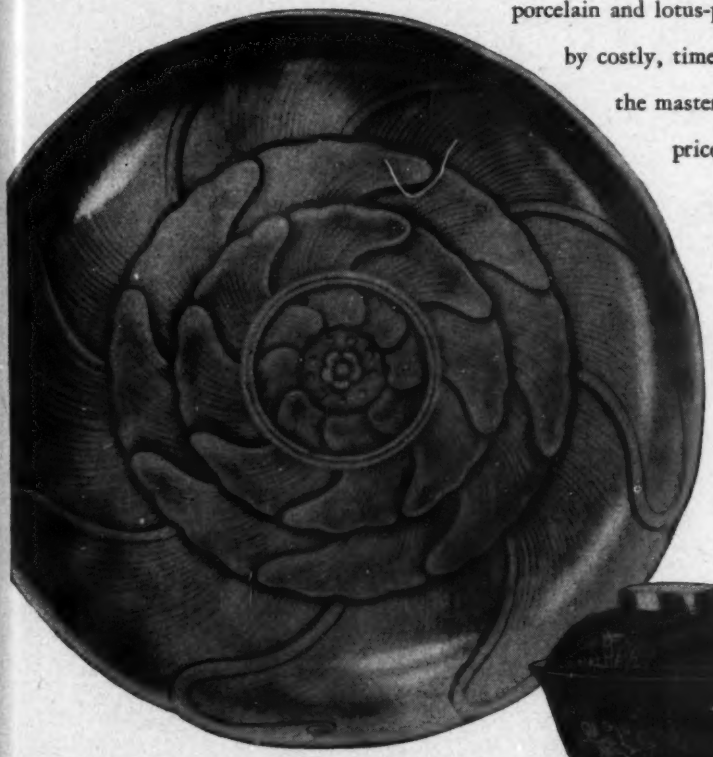
d. Thermal insulation. Finally it may be remarked that scale glass is a good thermal insulator. In this case, scales of about 25 μ thickness must be taken, so that a loose structure is obtained.

REFERENCES

1. H. C. Hamaker, Rec. trav. chim. 55, 1015, 1936, 56, 3, 1937; Chem. weekblad 35, 47, 1938.
2. E. J. W. Verwey, Rec. trav. chim. 60, 618, 1941.
3. E. J. W. Verwey, Rec. trav. chim. 60, 623, 1941.

the Chinese had no Gas

Ancient Chinese masters of ceramic art produced lovely Ch'ien Lung porcelain and lotus-patterned celadon for emperors and mandarins by costly, time-consuming firing with wood and grass. Now the masters and their patrons are gone, but they left a priceless heritage to modern ceramic artists.



Today these modern ceramists have GAS—dependable fuel for all ceramic firing. Automatic Gas equipment for the ceramic industry has removed the guesswork from heating operations; losses due to overheating or irregular temperatures no longer appear on operating records.

Modern production methods reproduce porcelain and china treasures as articles of commerce. GAS, efficient production fuel, fires the kilns, dryers, smelters, decorating ovens, in hundreds of plants manufacturing fine table and decorative ware.

Why not call the Industrial Representative at your local Gas Company for latest information on Gas-firing as applied to your manufacturing process?

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL CERAMIC FIRING

DUST SEALED
for your
PROTECTION

You breathe pure, dust-free air in a batch room equipped with Smith Glass Batch Mixers. That's because the Smith is *dust-sealed during the entire cycle of operations* — charging, mixing and discharging. There's no chance for dust to escape. Practically eliminates the dreaded silicosis hazard. Promotes employee health and efficiency, at the same time producing quality glass batches in the shortest possible mixing period.

New 40 cu. ft. Smith Glass Batch Mixer equipped with dust boot which confines dust within mixer drum.

Smith Glass Batch Mixer in discharge position. Fast "Tilt and Pour" discharge.

SCIENTIFIC MIXING OF GLASS BATCHES

The Smith duo-cone drum is famous for its effective "end-to-center" mixing action. Vertical cascading and unnecessary agitation are avoided by substituting a less violent rolling action. Segregation is eliminated, for mixing continues during the entire discharge cycle. Discharge is fast and complete. No corners or pockets in drum. No "left overs" to contaminate succeeding batches. Insures improved quality of glass batches and greater production. Built in all standard sizes up to 112 cu. ft. Write for bulletin.

The T. L. SMITH CO.
2898 NORTH 32ND STREET
Milwaukee 10, Wis., U. S. A.

SMITH
T. L. SMITH CO. MILWAUKEE

Glass Batch MIXERS

BROCKWAY MUSKOGEE PLANT . . .
(*Continued from page* 605)

tool grinding; complete mold cleaning setup; complete facilities for mold bench work and other small tools found in the usual mold repair shop. The overhead monorail is home-made.

The warehouse, like the main building, is of structural steel with corrugated iron siding. The warehouse itself covers 70,000 square feet. Reznor units are used for heating packing room, mold shop, decorating department and general maintenance shop. Floors are of concrete throughout most of the layout.

The laboratory is outstandingly well equipped and maintained for a plant of the size of Brockway's Number 3 factory. Main feature is, besides its completeness, the abundance of natural sunlight and accessibility of equipment. The usual equipment found in a glass plant laboratory is housed therein.

If space permitted we could of course add many more paragraphs describing minor details of this new plant which not only opens up a new territory for Brockway Glass Company but also will probably do much toward boosting the industry in general in this area, this being the sixth glass plant established in eastern Oklahoma.

INVENTIONS AND INVENTORS . . .
(*Continued from page* 624)

of glass H is thoroughly homogenized and it may be cut into sections or drawn as a rod in either case going to a lehr.

A test was run using lead-flint optical glass having the following composition, percentages being given by weight:

	Per Cent
Silica, SiO_2	46.5
Sodium oxide, Na_2O	5.0
Potassium oxide, K_2O	1.1
Calcium oxide, CaO	0.3
Lead oxide, PbO	47.0
Arsenic oxide, As_2O_3	0.1

This glass was melted from lumps which were seedy and badly striated. This molten glass was flowed through a homogenizer similar to that shown but having five dishes each having ten perforations. The resulting glass showed greatly improved optical quality.

Tests have also been run by adding a piece of cobalt blue to the glass being melted. This showed a very thorough mixing. This mixing operation is very aptly called "shuffling".

BLAU-UHRMANN REPORT AVAILABLE

It has recently been announced that the report made by Dr. Henry Blau and Mr. Carl Uhrmann on Glass Manufacture in Central Europe is now being distributed. This is an official report of their findings in Germany obtained during their trip this past summer.

The report may be ordered from the Department of Commerce, Office of Technical Services, Washington, D. C. Purchase order should be made out for PB No. 43457, "The Miscellaneous Glass Industry of Central Europe," by Dr. Blau and Mr. Uhrmann. The price is $2.00 each for Microfilm and $6.00 each for Photostat.

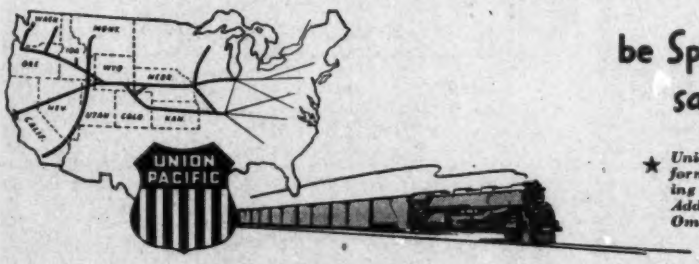
A MESSAGE TO THE GLASS INDUSTRY

More POWER to You

Three great dams, harnessing the natural force of the Colorado and Columbia Rivers, provide tremendous industrial power.

Giants of the rails, the Union Pacific "Big Boy" locomotives provide freight transportation power over the Strategic Middle Route.

Power, light, and efficient transportation . . . combined with a wealth of raw materials and adequate "growing space" . . . offer unusual opportunities for industry in the Union Pacific West.



be Specific – say "Union Pacific"

★ *Union Pacific will gladly furnish confidential information regarding available industrial sites having trackage facilities in the territory it serves. Address Industrial Dept., Union Pacific Railroad, Omaha 2, Nebraska.*

UNION PACIFIC RAILROAD

The Strategic Middle Route

O. HOMMEL COMPANY products are recognized as a standard in the CERAMIC INDUSTRY

● Background of 55 years experience

● Staff of skilled technicians and laboratories . . . available to you.

O. HOMMEL CO.

PITTSBURGH 30, PENNA.

FIRE AT BALL BROTHERS PLANT

The Ball Brothers glass plant in Muncie suffered a fire loss of $300,000 in October when its largest warehouse, two blocks long, was totally destroyed by fire. Seventy-five firemen were used to stop the blaze which threatened other buildings of the giant glass jar plant.

About three weeks ago, fire destroyed a portion of the company's paper plant at Noblesville, Indiana, with a loss of about $60,000.

PEMCO INCREASES STAFF

Pemco Corporation has announced the addition of two new service engineers to its staff in a move to adequately staff every department of its organization.

Theadore Buit has been assigned to the Michigan-Indiana area staff. Mr. Buit joins Pemco after twenty-five years with the Norge Division of the Borg Warner Corporation. His first job in the industry was with the Alaska Company and in 1924, was sent to Pemco Corporation under a training program agreement with the Alaska Company. After a year, he returned to the Alaska Company as General Foreman in their Muskegon plant.

Herold N. Reed has been assigned to work with the Pemco Pennsylvania-Ohio and Ohio-Indiana area service staff. After his graduation in 1935 from Ohio State University as a Ceramic Engineer, he joined the Tyler Fixture Corporation and remained with that company until his enlistment in the Army in 1942. After three and one half years, he returned to the Tyler Fixture Corporation until his present assignment.

GAS-AIR-OXYGEN
BURNERS
ECONOMIZERS
MIXERS
GLASS ROLLERS
GENERAL GLASS WORKING EQUIPMENT

Glass working equipment manufacturers glass ampules, vials, etc. Glass working lathes, bench fires and laboratory equipment of all types. Write for catalog

CHAS. EISLER
EISLER ENGINEERING CO.
742 SO 13th STREET

BORAX and BORIC ACID
99½-100% Pure

CAUSTIC SODA
NITRATE OF POTASH SULPHUR

OTHER STAUFFER PRODUCTS

*Aluminum Sulphate	Cream of Tartar	Sulphuric Acid
Borax	Chlorine	Sulphur Chloride
Boric Acid	Muriatic Acid	*Superphosphate
Carbon Bisulphide	Nitric Acid	Tartar Emetic
Carbon Tetrachloride	Silicon Tetrachloride	Tartaric Acid
Citric Acid	Sodium Hydrosulphide	Titanium Tetrachloride
*Copperas	Stripper, Textile	

(*Items marked with star are sold on West Coast only.)

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL CO.

KNOX NAMES ASSISTANT TO PRESIDENT

R. R. Underwood, President of Knox Glass Associates, Inc., has announced the appointment of George B. Underwood as Assistant to the President.

The newly appointed assistant joined the Knox Group in 1936, was later named Assistant Traffic Manager and in 1939 was transferred to the Sales Division in the central office. Prior to his induction into the armed forces, Mr. Underwood served in the capacity of Division Sales Head, Miscellaneous Sales Department of the Knox Glass Associates.

Mr. Underwood will make his headquarters in the offices of the company at Knox, Pa. However, for the next several months, he will divide his time between the eleven factories in the Knox Group of companies in order to augment his operating knowledge and to thoroughly familiarize himself with the production changes made during his military leave of absence.

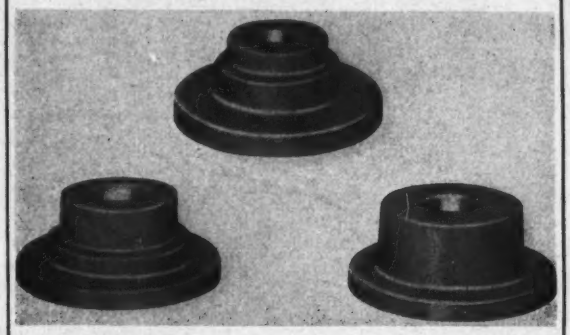
A.G.A. COMMITTEE TO SUBMIT STATEMENT ON TARIFFS

The Tariff Committee of the American Glassware Association will meet shortly to prepare plans for presenting a statement of the opinion of Association members on tariff negotiations on glassware produced by them.

The Association Tariff Committee, as appointed by the Board of Directors, is James Gillinder, Chairman; C. W. Carlson, Vice Chairman; W. O. Barry, W. L. Orme, C. B. Roe, C. J. Uhrmann, and Louie Wohinc; Guest Members, George Dougherty, H. H. Cook and W. G. Muhleman.

Gunite's Standard Grade A for

Guide Rings



Like all Gunite glasshouse castings Standard grade A is used for guide rings because it is best adapted to this particular purpose.

There is a suitable Gunite Alloy for every type of glass making part, including Plungers, Guide Rings, Neck Ring Sticks, as well as Round Bar Stock.

Send for descriptive bulletin

GUNITE FOUNDRIES CORPORATION

ROCKFORD ILLINOIS

POLAROID*

Glass Inspection polariscope

Large Field — Brilliant Strain Patterns Adjustable — Binocular Viewing — Precise

If your problem is strain detection we can help you through Standard Equipment or Special adaptations.

Send for descriptive bulletin

THE POLARIZING INSTRUMENT CO., INC.

41 EAST 42nd STREET NEW YORK CITY, 17

*T.M. Reg. U.S. Pat. Off.

ESTABLISHED 1912

NATIONAL AIROIL FUEL OIL GAS BURNERS

MORE THAN

34 YEARS

EXPERIENCE

in the design, development and manufacture of Oil, Gas and Combination Burners for all types of industrial applications (including many in the Glass and Ceramic Industries) helps us meet and satisfy many combustion requirements.

LET US HELP YOU.

Our accumulated knowledge and experience is at *your* service . . . consult our engineers, today.

NATIONAL AIROIL BURNER CO., Inc.

1255 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PENNA.

TEXAS OFFICE: 2ND NATIONAL BANK BLDG., HOUSTON

CLASSIFIED ADVERTISEMENTS

HELP WANTED

WANTED: Man with experience to manage pressed ware grinding and finishing department in hand glass factory. Reply Box 51, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

EXPERIENCED GLASS PLANT CHEMIST—To take charge of laboratory in new Fourcault plant being built in Cairo, Egypt. Must be capable of doing all necessary analytical work and training Egyptian assistants for a minimum of one year starting about January 1, 1947. Application should include full details as to qualifications, experience, references and salary required. Excellent opportunity for a good man to broaden his experience on a leave-of-absence basis. Address Box 50, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

WANTED—Experienced man for Decorating Department Assistant. Excellent Opportunity. State experience and age. Reply Box 46, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

CLIPPER MANUFACTURING CONSOLIDATES OFFICES

The Clipper Manufacturing Company has announced its plans to consolidate, in part, its St. Louis office with its newly completed factory and general office building in Kansas City, Missouri. The St. Louis warehouse will remain intact as a permanent shipping point serving customers in that area.

Manufacturing facilities have been expanded and a complete laboratory added. The address of the company's new location is 2800 Warwick, Kansas City 8.

PENNSALT STOCKHOLDER REPORT

Consolidated net earnings after deduction of Federal taxes of the Pennsylvania Salt Manufacturing Company for the twelve months ending September 30 were $1,790,863.77, or $2.39 per share on 750,000 shares of $10 par stock, according to an announcement made by Leonard T. Beale, President of the company.

The net earnings for the same period ending September 30, 1945, were $1,356,296.98 equivalent to $1.81 per share.

At the annual meeting, Leonard H. Kinnard, Charles G. Berwind and Richard T. Nalle, all of whom have been directors of the company, were reelected for three-year terms. Alexander J. Cassatt, also a director of the company, was elected to a one-year term.

THE SHARP-SCHURTZ COMPANY

CHEMISTS AND CONSULTING ENGINEERS

FOR THE GLASS INDUSTRY

LANCASTER, OHIO U. S. A.

GLASS SPECIALTIES

Transparent Colored Blown Sheet Glass
Solid Pot Opal Blown Sheet Glass
Flashed Opal Blown Sheet Glass
Colonial Antique Colored Glass
Heat-Ray Resisting (Cool Glass)
"TWIN-RAY"—the scientific illuminating glass.

HOUZEX

L. J. HOUZE
CONVEX GLASS CO.
POINT MARION, PENNSYLVANIA
New York Office: 110 West 40th Street
Chicago Office: 1597 Merchandise Mart
"IF IT'S MADE OF GLASS, ASK US FIRST"

High Grade
POTASH Feldspars

CLINCHFIELD SAND & FELDSPAR CORP.
618 Mercantile Trust Bldg., Baltimore 2, Maryland

1907 was a great year . . .

and 1930 was one of world-wide depression

In 1930 the price of farm wheat fell to 61 cents a bushel, lowest since 1899 . . . corn went down to 66 cents a bushel. Many banks suspended business in Ark., Ky., Ill., Mo., N. C.; the Bank of United States in New York closed . . . the largest banking suspension in the history of the state.

In 1930 the supply of Banner Lime was more than adequate to meet the demand. Today, utmost efforts are being made to increase production in order to meet more fully and satisfactorily the heavy current requirements of Building, Agriculture and Industry. National Mortar and Supply Company, Grant Building, Pittsburgh, Pa., Established 1907.

Essentially yours Banner Lime
FAMOUS OHIO DOLOMITE

In 4 essential industries—agriculture, building, glass and steel . . . lime and limestone are essential